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Old Series Vol. X | CONTINUATION OF THE BULLETIN OF THE NORTHEASTERN BIRD-BANDING ASSOCIATION | New Series Vol. V

BIRD-BANDING

A Journal of Ornithological Investigation

Vol. V July, 1934 No. 3

PUBLISHED FOR
THE NORTHEASTERN BIRD-BANDING ASSOCIATION
THE EASTERN BIRD-BANDING ASSOCIATION
AND
THE INLAND BIRD-BANDING ASSOCIATION

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BIRD-BANDING

A JOURNAL OF ORNITHOLOGICAL INVESTIGATION

VOL. V. JULY, 1934 No. 3

INDIVIDUAL AND SEXUAL VARIATONS IN THE EUROPEAN STARLING

By LAWRENCE E. HICKS

THE first record of the European Starling (*Sturnus vulgaris vulgaris*) from Ohio was in January, 1916. The bird was recorded every year thereafter, being known as a breeding species from 1920 on. All parts of the State had been invaded by 1923, and the species was everywhere abundant by 1928. The Starling is now the most numerous winter resident and one of the five most numerous breeding birds of the State.[1]

Because of its numbers, aggressiveness, motility, omnivorous food habits, and promise as a research subject, the Starling was thought deserving of a detailed study. Much has been learned of the species through the coöperative bandings in the Columbus region conducted by various members of the Wheaton Club. During the last seven winters 29,884 were banded, the summer captures bringing the total to 30,151. About 38,000 birds have been handled, some attention usually being given to individual differences. Mr. Edward S. Thomas compiled the recovery and return data of the early banding work of 1927–1930.

TABLE NO. 1. STARLINGS BANDED IN CENTRAL OHIO, 1927–1934

Winter	*Number of Bandings*	*Dec.*	*Jan.*	*Feb.*	*Mar.*	*Total*
1926–27	7	0	0	269	587	856
1927–28	6	208	333	263	724	1528
1928–29	9	0	960	1689	2164	4813
1929–30	4	0	275	173	1	449
1931–32	4	0	0	0	1474	1474
1932–33	23	1584	702	1895	2034	6215
1933–34	32	1266	3144	3098	7041	14547
Totals	85	3058	5414	7387	14025	29882

[1] Hicks, Lawrence E., *The Auk*, 50:317–322, 1933.

From March, 1932, to March, 1934, inclusive, the writer, with the help of one or two student assistants, banded 16,696 birds[2] while handling more than 25,000 individuals. A study made of the individual and sexual variations of many of these living birds and of 3284 kept as specimens is the basis for the present paper. At all times specimens were taken in sufficient quantity and in such a way as to be actually representative of the total flock as determined by experiment. The great majority of the specimens were taken from a large roost of one thousand to eight thousand birds found in ten towers at the Ohio State Hospital, Columbus, Ohio. Many others came from eighteen roosts in towers, steeples, ventilators, and warehouses of the downtown district of Columbus. Collections were also made from twenty-two roosts elsewhere in Franklin County and from nineteen roosts located from fifteen to sixty miles from Columbus. In addition, 284 birds were shot from forty-seven feeding flocks in the field in sixteen central Ohio counties.

I. SEX RATIOS

During the study 3161 Starlings were sexed by internal examination. The sexual organs are sufficiently large throughout the winter to make determination easy.

Of 171 examined in March, 1932, 121, or 70.8 per cent, were males. Of 468 examined during the winter of 1932–33, 313, or 66.9 per cent were males. Of 2522 examined during the winter of 1933–34, 1714, or 67.9 per cent, were males. The percentages of males by months for 1933–34 were: December, 70.1 per cent of 147 birds; January, 64.3 per cent of 252; February, 63.1 per cent of 431; March, 69.7 per cent of 1691 birds. Smaller samples taken during other months of the year were inconclusive as to the actual sex ratio. It seems almost impossible to obtain during the nesting season an adequate sample which will be truly representative of the whole population from the standpoint of sex ratio. However, extensive field observations during the breeding season seem to indicate that the males are somewhat in the majority, though probably not to the extent found in winter.

This unbalanced sex ratio, if actual for the whole American Starling population, is of great biological interest—and perhaps of significance from the standpoint of behavior and reproduction of the species. A preponderance of males has been

[2] Hicks, Lawrence E.: *Bird-Banding*, 4:112, 1933; *Bird-Banding*, 5:42–43, 1934; *Bird-Banding*, 5:93–94, 1934.

reported for many other species, including most of the ducks of the eastern United States (Lincoln, McIlhenny, and others), but seldom has it been suspected that the males of a species outnumbered the females as much as 3 to 2, 2 to 1, or even 3 to 1.

In Europe several writers have surmised that male Starlings probably somewhat outnumbered the other sex. One bit of evidence given is that during the breeding season apparently unmated males sometimes build dummy nests or females may consort with more than one male.

If this observed unbalanced sex ratio for Central Ohio in winter does not apply to the total Starling population of the United States, we then have problems to solve as to where the "missing" females winter, and why the sex rations of widely separated localities differ either temporarily or permanently. It would be of great value if some observers in each section of the eastern United States, would sex an adequate sample of Starling specimens taken from several roosts at all seasons obtainable.

During the present study several ornithologists have looked over one or more specimen lots and by suggestions helped to formulate the following statements which limit the possible explanations of the lop-sided sex ratios found in Central Ohio Starlings in winter:

1. Differences in the habits and the behavior of the two sexes could not account for the preponderance of males at the large roosts, as their roosting habits are essentially the same and the females have been found to be no less gregarious than the males at this season.

2. The size and location of the roosts from which the specimens came cannot be used as an explanation, as collections from roosts in rural districts, from numerous small roosts of 2 to 25 birds each and from birds shot in the field, give the same general sex ratios.

3. Collections from widely separated Ohio localities give nearly the same sex ratios; hence male Starlings must actually far outnumber the females in Ohio, at least from December 1st to April 1st.

4. A greater percentage of the females may winter southwest of Ohio than of the males, accounting for their being in the minority. Examples of this type have been reported in several species, including the Mississippi Song Sparrow (Nice). Collectors also usually find that winter-collected individuals of most semi-hardy passerine species include a very high percentage of males. If, however, the great bulk of the Starling

females wintered south of Ohio, their numbers should be proportionately increased during the spring migration. This is not true. Instead, the males are even better represented during the spring migration period than during the winter months. Hence, we can hardly believe that the unaccounted-for females winter south of Ohio.

5. The "missing" females may winter to the north of Ohio; *i.e.* the center of winter distribution for the female Starling population may be north of that of the males. If this is the correct explanation, it could be easily verified by other observers in the Northern States and southern Canada. This alternative seems unlikely, however, as there is no known parallel among other species.

6. A last and more likely suggestion is that the females are actually, decidedly outnumbered in the total Starling population of the country, though owing to migration influences or differences in the behavior and habits of the two sexes, the difference may not be as great as data now available would seem to indicate.

In Table No. 2, the number and percentage of males and females found in collections taken during the winter of 1933–34 are shown. Numerous small collections from scattered localities are omitted for the sake of brevity and because lots of less than about 35 birds have been found to be inadequate samples and may not actually be representative of the whole flock.

TABLE NO. 2. SEX RATIOS OF STARLINGS—WINTER OF 1933–34

Date	*Number of Specimens*	*Number of Males*	*Number of Females*	*Per cent of Males*	*Per cent of Females*	*Where Collected*
Dec. 6	33	22	11	66.6	33.4	State Hospital, Columbus
Dec. 16	50	38	12	76.0	24.0	State Hospital, Columbus
Jan. 6	34	22	12	64.7	35.3	State Hospital, Columbus
Jan. 20	52	30	22	57.9	42.1	State Hospital, Columbus
Jan. 25	24	16	8	66.6	33.4	Columbus Mattress Co.
Jan. 27	39	24	15	61.6	38.4	Canal Winchester
Feb. 1	112	67	45	59.8	40.2	Linworth
Feb. 5	85	54	31	63.5	36.5	State Hospital, Columbus
Feb. 6	108	66	42	61.1	38.9	J. P. Gordon Co., Columbus
March 6	141	84	57	59.7	40.3	State Hospital, Columbus
March 16	218	154	64	70.6	29.4	State Hospital, Columbus
March 17	336	238	98	70.8	29.2	State Hospital, Columbus
March 21	173	132	41	73.9	26.1	Mt. Vernon
March 23	322	234	88	72.7	27.3	State Hospital, Columbus
March 24	254	173	81	68.1	31.9	State Hospital, Columbus
March 31	192	123	69	64.1	35.9	State Hospital, Columbus
Totals	2173	1487	696 Av.	68.3 Av.	31.7	

The data when evaluated make possible the following generalizations:

1. The percentage of males in Central Ohio in December is usually high—nearly 70 per cent—although considerable difference is found in the sex-ratios of different roosts at that time. Both facts are believed to be due to a partial separation of the sexes or a shuffling of mixed populations during migration. (Returns from banded birds indicate that considerable migration and shifting of the population takes place in the fall in most years until late in December.)

2. The percentage of males in January and early February ranges from about 60 per cent to 64 per cent (relatively low). During this period the percentage of males varies only slightly with different roosts, and the percentage of males at any one roost is nearly constant unless an early migratory movement takes place.

3. During late February and March (the big migration month) the roosts usually double or triple in size owing to the influx of birds from the southwest—and to the attraction of birds from the smaller rural roosts as the expression of the gregarious instinct becomes increasingly pronounced. During this period the percentage of males gradually mounts to a high of 70 per cent to 74 per cent, and then gradually decreases to about 63 per cent as the last flocks break up or leave for the northeast. Note that the percentage of males never drops below 58 per cent to 60 per cent.

4. The rise and then the fall of the percentage of males during migration are believed to be due to the bulk of the males performing the spring migration to the northeast to the breeding grounds slightly in advance of the bulk of the females. Similar cases have been detected in the Eastern Red-wing and the Eastern Cowbird, where the earlier advance of the males is readily observable by our being able to distinguish the sexes by plumage or song characters in the field.

5. During March at the Ohio State Hospital, towers observed to be attractive to the more wary migrants, contained 70 per cent to 76 per cent males. (The few bands on these birds also indicated that they were chiefly migrants.) Two towers with very small hidden openings, and hence not likely to be entered by migrants, had a lower percentage of males—64 per cent to 68 per cent. (The many bands on these birds indicated that they were largely winter residents—not migrants.)

6. As one would expect from the above, roosts receiving few migrants had a somewhat lower percentage of males. Also, adjacent roosts tended to have nearly the same percentage of males. (Examples—the several towers at the Ohio State

Hospital roost, the several roosts in the downtown district of Columbus, or roosts in barn cupolas of the same township). The larger roosts and the city roosts averaged a slightly larger percentage of males.

II. WEIGHTS OF STARLINGS

During the study the weights of more than two thousand male Starlings collected were compared with the weights of about half as many females. Several hundred birds shot in the field were also compared with the specimens taken at roosts at night. The data summarized in table No. 3 are of birds taken from various roosts in central Ohio, mostly during the winter of 1933–1934. The lots are nearly comparable, for all were collected at approximately four hours after sunset, or about five hours after the last possible feeding. At this time the stomachs are nearly empty of food; so the weight listed is very near to the true body weight.

During the winter period (December to March), 1942 males averaged 84.67 grams, and 915 females 79.89 grams. Thus the average male Starling in central Ohio in winter outweighs the average female by 4.78 grams. In December the males average 81.46 grams, and the females 77.15 grams. This relatively low weight during the early winter is believed mostly due to the immature portion of the population not having reached full development. (Banded returns, at least one and one-half years old, average 4–8 grams heavier). Undersized birds collected in December usually prove to be immature. If decidedly undersized they are almost invariably immature females. Perhaps these small birds are from late broods. The relatively low December weight may also be partly due to activities of the late fall migration and adjustment to the wintering locality.

By January these small immatures have nearly reached their complete development; so the total male population averages 84.65 grams and the females 80.73 grams. Both sexes reach their maximum weight in early February, the males in this month averaging 87.42 grams and the females 82.24 grams. In March both sexes decrease slightly in weight (males 85.15 grams, and females 79.46 grams), probably owing to the spring migration and the greatly increased activity with more hours of daylight. Also it should be noted that many of the December birds and most of the March birds captured are not winter residents in central Ohio.

Females average 4.31 grams lighter than the males in December. As the small females mature in another month, this sex averages only 3.92 grams less than the males in

January. In February and March the males exceed the females by 5.18 grams and 5.69 grams. This relative increase in weight of the males over the females is difficult to explain but is believed to be linked with their earlier increase in glandular (and sexual?) activity, as evidenced by their behavior and the development of secondary sexual characters, such as bill color.

Unusually large or small specimens of both sexes were weighed separately. Ranges established for the males were 73 to 96 grams and for the females 69 to 93 grams, although rare dwarf, giant, or diseased individuals somewhat exceeded these weight limits. Ninety per cent of the population, however, usually fell within relatively narrow limits.

No correlation could be noted between body weight and the feeding territory of the birds. Starlings known to feed entirely in rural sections averaged nearly the same as others known to feed mostly within the city limits of Columbus. However, weather conditions were found to have sufficient influence on body weight to sometimes obscure seasonal weight trends. Weight fluctuations of individual birds were found to be due mostly to the gain or loss of a fatty layer which is very conspicuous after incision of the body. A thick fatty layer may develop within one to two weeks or may be lost under adverse conditions in four or five days.

TABLE NO. 3. SEXUAL DIFFERENCES IN THE WEIGHTS OF STARLINGS

Date	*Number of Males*	*Average Weight of Males*	*Number of Females*	*Average Weight of Females*	*Where Collected*
Dec. 6, 1933	112	80.12	55	76.81	State Hospital, Columbus
Dec. 16, 1933	226	81.34	117	77.12	State Hospital, Columbus
Dec. 22, 1933	23	82.91	13	77.51	Fredericktown
Jan. 6, 1934	22	87.65	12	84.65	State Hospital, Columbus
Jan. 20, 1934	30	86.46	22	81.19	State Hospital, Columbus
Jan. 25, 1934	32	84.20	16	78.64	Columbus Mattress Co.
Jan. 27, 1934	24	80.29	15	78.43	Canal Winchester
Feb. 1, 1934	67	87.63	45	82.52	Linworth
Feb. 2, 1934	42	87.06	20	83.15	Columbus Merchandise Co.
Feb. 5, 1934	54	88.99	31	80.93	State Hospital, Columbus
Feb. 6, 1934	66	87.21	42	82.35	Gordon Co., Columbus
Mar. 6, 1934	84	82.21	57	77.08	State Hospital, Columbus
Mar. 16, 1934	154	87.14	64	81.50	State Hospital, Columbus
Mar. 17, 1934	238	85.75	98	80.71	State Hospital, Columbus
Mar. 21, 1934	132	85.90	41	78.53	Mt. Vernon
Mar. 23, 1934	234	87.71	88	81.02	State Hospital, Columbus
Mar. 24, 1934	173	85.64	81	80.71	State Hospital, Columbus
Mar. 31, 1934	192	85.27	69	80.11	State Hospital, Columbus
Mar. 28, 1932	37	81.02	29	76.22	State Hospital, Columbus
Totals	1942		915		

December—81.46	December—77.15 (4.31 g. less than males)
January — 84.65	January —80.73 (3.92 g. less than males)
February —87.42	February —82.24 (5.18 g. less than males)
March —85.15	March —79.46 (5.69 g. less than males)

Starlings commonly gain weight in cold weather if the ground is bare or the snowfall light. When heavy snows come, much of the food consumed is garbage from cities or grain put out for livestock. Starlings in central Ohio seldom "freeze" or starve, as the fatty layer usually suffices to carry the birds over until the end of the usually brief cold wave. As in most species, starvation takes place only after cumulative effects. Winters of New York and Ontario, with many long severe cold waves and deep snows, certainly result in the destruction of an appreciable portion of the Starling population, as many recoveries from those regions, during the unusually severe winter of 1933–1934, of birds banded at Columbus, had an added note "bird found dead (or dying) of cold at a weather temperature of 22 (to 49) degrees below zero."

Starlings at Columbus (winter of 1933–1934) did not lose weight during the near-zero weather of December 26th–29th and actually gained weight during the near-zero weather of January 28th–31st. However, the sub-zero weather of February 8th–10th, followed by the long near-zero cold wave and snows of February 20th–28th, resulted in an average loss of 9.1 grams weight per bird. Many are known to have perished from starvation. The February temperature average was 22 degrees F., 8.7 degrees below normal. Half of this lost weight was regained during the first week, and all of it during the first two weeks of relatively warm weather in March.

III. Development of Bill Color

During the breeding season all but 2 to 4 per cent (mostly non-breeding birds, diseased or immatures, usually females) of the total population have beautiful golden-yellow bills (usually appearing cream-colored in the field). By late fall or early winter only 5 to 10 per cent of the population have yellow bills, though 5 to 15 per cent more may show some trace of yellow. The remainder have bills of grayish-black. We are not yet able to explain why these few birds retain the yellow bills, except that the problem is a physiological one (nearly all such birds are large vigorous adult males). At all times of the year, a greater percentage of the males than of the females have yellow bills. At certain periods nearly all birds showing much yellow in the bill are males.

The change from black to yellow is a gradual one, the yellow first appearing near the base, and the last dark area to disappear being at or near the tip. During the winter of 1933–1934, 2705 Starling specimens were studied by sexes as to the bill color. Several hundred birds repeated during the winter from

one to eight times, and, where possible, the gradual development of bill color was noted.

A careful study of most of the banding data of 31,000 Starlings banded discloses that there is no good evidence that immature Starlings ever develop any yellow bill color before January first. In fact, it seems certain that the population groups develop colored bills in the following order: old males, old females, immature males, and immature females. A few of the latter may retain the dark bill during the first spring.

As a working basis, birds of each lot studied were divided arbitrarily into three groups: "yellows" (bills more than 85 per cent yellow), "partials" (bills 20 per cent to 85 per cent yellow) and "darks" (less than 20 per cent yellow). Usually few birds were border-line cases, so that a lot may be re-sorted several times with practically the same results in each case.

Bill color in the Starling is linked with the health and general physiological condition of the bird, the sex and the degree of sexual maturity and activity, and, to a certain extent, with age. Few of the five- and six-year-old birds taken have had yellow bills.

Hence, when different roosts on the same date are found to have different percentages of yellows, partials, and darks, the explanation is that the roosts have, (1) different sex ratios, (2) different percentages of immatures, or (3) different proportions of migrants. Birds arriving from new localities (1) may have been subjected to different environmental influences, and hence be in a different stage of sexual development, or (2) may represent the "cream," *i.e.* an isolation through migration of a group of the most sexually active birds.

As a relatively greater proportion of the yellow-billed birds are males, birds with colored bills will average heavier than the total population. Of 85 birds taken on February 5, 1934, the 33 yellows averaged 88.92 grams each, the 20 partials 84.34 grams, and the 29 blacks, 82.61 grams.

Table No. 4 gives the percentages of yellows, partials, and darks found in the total population on each date. Pronounced development of the bill color begins in January. First a decided increase in the percentage of partials in noted, then a rapid increase in the percentage of yellows. When the last flocks break up or leave for the northeast (usually about April 1), 85 per cent are yellow bills, another 12 per cent are partials, and only 3 per cent to 4 per cent blacks. The 180 birds taken at Mt. Vernon on March 21st gave an unusually high percentage of yellows (96.1 per cent). This flock probably

was composed entirely of migrants, as not a single bird from a previous banding at the same place was included.

TABLE NO. 4. DEVELOPMENT OF YELLOW BILL COLOR IN MALE AND FEMALE STARLINGS, 1933–1934

Date	Bill Color (Total Population)				Percentage of Each Sex Having Bills				Where Collected
	Number of Birds	Per cent Yellow	Per cent Partial	Per cent Dark	Yellow ♂	Yellow ♀	Partial ♂ ♀	Dark ♂ ♀	
Dec. 16	343	8.4	11.3	80.3	10– 2	14– 4	76–96		State Hospital
Jan. 6	299	10.7	15.4	73.9	14– 2	17– 7	69–91		State Hospital
Jan. 20	52	15.4	48.1	36.5	13–18	67–23	20–59		State Hospital
Jan. 25	24	33.3	37.5	29.2	50– 0	31–50	19–50		Mattress Co.
Jan. 27	39	46.2	25.6	28.2	62–20	21–33	17–47		Can.Winchester
Feb. 1	112	37.5	25.8	36.6	57.–9	25–27	18–64		Linworth
Feb. 5	85	42.3	25.3	34.1	61–10	19–32	20–58		State Hospital
Feb. 6	108	25.0	40.7	34.3	40– 2	44–36	16–62		Gordon Co.
Mar. 6	141	44.1	46.8	9.2	62–18	35–64	3–18		State Hospital
Mar. 16	218	74.3	18.8	6.9	86–47	13–43	1–20		State Hospital
Mar. 17	336	72.6	22.0	5.3	81–53	17–33	2–14		State Hospital
Mar. 21	180	96.1	3.5	.6	99–87	1–11	0–2		Mt. Vernon
Mar. 23	322	76.7	18.6	4.7	84–58	14–31	2–11		State Hospital
Mar. 24	254	70.5	23.6	5.9,	79–52	19–35	2–13		State Hospital
Mar. 31	192	84.4	12.0	3.6	90–75	10–15	0–10		State Hospital

Table No. 4 also gives the percentage of the birds of each sex which were yellows, partials, or darks, in each collection. The data show that the majority of the males are either yellows or partials by January 10th and that after late January more than half of them are yellows. During the March migration three-fourths to four-fifths of the males have yellow bills and less than 3 per cent black bills. The percentage of females with colored bills also mounts, but at a later date and less rapidly, until nearly 75 per cent are yellows, 15 per cent partials, and little more than 10 per cent darks, with the disappearance of flocking birds about April 1st.

IV. SEX DETERMINATION BY EXTERNAL CHARACTERS

The writer has been questioned repeatedly by various ornithologists as to whether there are any external characters which can be used to differentiate the sexes in the Starling. Mr. Frederick C. Lincoln (letter of January 8, 1934) writes: "I do not know of any reliable external characters. Occasionally a coöperator will attempt to sex one of these birds that he has banded, but I have never been satisfied as to the reliability of this part of the record." Dr. H. C. Oberholser (letter of January 17, 1934) writes, "While there is no certain method of determining the sex of Starlings by external characteristics, it usually is the case that the female has less brilliant plumage, with more numerous light tips on the feathers."

Because of the great interest in this question, an attempt was

made to determine the value and extent of all external variations. During the study 3161 Starlings were judged as to sex on the basis of external differences. Later these judgments were tested by internal examination.

TABLE NO. 5. SEX DETERMINATION BY EXTERNAL EXAMINATION

Month	*Per cent of Males Correctly Sexed*	*Per cent of Females Correctly Sexed*	*Per cent of Total Population Correctly Sexed*
December	94.5	78.2	89
January (first half)	95.4	79.6	90
January (last half)	96.2	81.2	91
February (first half)	98.2	86.2	94
February (last half)	99.6	93.7	98
March (first half)	100.0	99.3	99.8
March (last half)	100.0	100.0	100.0

The work indicated that practically all of the adult males can be determined at any time during the winter, the few males misdetermined being immature birds. After the first of February practically no males are misdetermined, and after the first of March perfect results may be obtained. Most of the females misdetermined also are believed to be immature birds from general appearance, size, and the fact that none carry bands from the previous winter. After February 1st nearly perfect results can be obtained. During March, 1934, 968 males and 427 females were sexed without error except in the case of three females. These sexual differences remain obvious during the breeding season, but during the late summer, fall, and early winter determination becomes increasingly difficult. Considerable experience and practice are necessary to sex Starlings in the early winter, as a number of characters must be carefully evaluated, none of which are more than about 70 per cent to 90 per cent constant with sex. In January and February nearly all birds begin to show a secondary sexual character (color of the base of the lower mandible), which upon becoming discernible, makes 100 per cent determination possible.

The following sexual differences have been used as aids or important criteria in external sexual determination. The extent and the value of each are discussed.

1. *Color of Base of Lower Mandible*

The one infallible criterion for sexual determination, is the color of the basal half of the lower mandible.[2] As the breeding

[2] Another character which may prove to be of equal value in the living bird, eye color, will be reported upon later after more extensive studies.

season approaches, this area becomes conspicuously bluish white to bluish gray in the males and pinkish white to pinkish gray in the females. Unfortunately this character is a seasonal one. It is such a very obvious and definite character, however, that even bird-banders inexperienced with this species may safely sex birds caught during the months of March, April, May, and June. During the other months most of the adults show some color trace, though for a quarter of the year the black color of the bill may entirely obscure this character to even the most expert observers. This character usually becomes fairly obvious before the remainder of the bill begins to show much yellow. Like the yellow bill color, it shows with more faithfulness in the males, in adults, in sexually active and mature birds, and in birds in good health.

2. *Brilliancy of the Plumage*

In general the males average considerably more brilliant in plumage than the females, but this varies greatly with the season. The females commonly have more light tips on the feathers and these wear away less rapidly than on the males. Brilliancy of the head, neck, breast, and shoulders is of much less value than the brilliancy of the sides, belly, and back. If fifty specimens of each sex are arranged in one row in the order of the general brilliancy of the plumage, many females will be near the brilliant end of the series and some of the males near the dull-plumaged end of the series. Several of the largest and most brilliantly plumaged birds ever handled have been females. This character when used in connection with others, however, is often of considerable value.

3. *Bill Color*

In another part of this paper the change from dark to partial to yellow bill color in each sex is discussed. In December nearly all of the birds with yellow bills are males, and at all times of the year a greater percentage of the males than of the females have yellow bills. However, some females always have yellow bills and practically all have colored bills during the breeding season. This character is also of great value when used in connection with others.

4. *Measurements and Weights.*

As stated elsewhere in this paper, the males average larger than the females by 3.1 millimeters in total length, 2.5 millimeters in wing-length, 2.3 millimeters in tail-length, .7 millimeters in length of exposed culmen and 4.78 grams in weight.

These differences are slight, but of some value, as they are more constant than others more frequently used, such as the brilliancy of the plumage.

V. MEASUREMENTS

About 560 Starlings have been measured to determine the extreme and average size-variations between the sexes. All measurements were made according to the standard methods described by Baldwin, Oberholser, and Worley ("Measurements of Birds," 1931). Birds taken during the fall and early winter averaged somewhat smaller than the measurements given below, owing to the large portion of immatures in the population which have not reached full development at that time. Also measurements of the total length in the living bird as reported by Wetherbee[3] are considerably less than those found for Ohio birds measured in a dead and relaxed condition. Stevenson,[4] 1933, has reported sexual differences in the Starling in body-weight and length of the small intestine.

The males were found to have a somewhat greater range of size fluctuation than the females for all measurements. The average male measurements also exceeded those of the females for total length, 3.1 millimeters; wing-length, 2.5 millimeters; tail-length, 2.3 millimeters; and exposed culmen, .7 millimeter. These represent differences of 1½ per cent to nearly 4 per cent. Table No. 6 gives the maximum, minimum, and average measurements of 104 males and 72 females taken at the Ohio State Hospital, Columbus, Ohio, on March 6, 1934. On this date all immature birds have reached approximately full development. Also banding data indicated that the population at that time was almost entirely made up of winter residents.

TABLE NO. 6. MEASUREMENTS OF 104 MALE AND 72 FEMALE STARLINGS IN MILLIMETERS

	Males			*Females*		
	Maximum	*Minimum*	*Average*	*Maximum*	*Minimum*	*Average*
Total Length	231	206	218.2	224	203	215.1
Wing-Length	136	123	129.0	131	120	126.5
Tail-Length	68	59	63.4	66	58	61.1
Exposed Culmen	31.5	24.0	27.4	30.0	24.5	26.7

Of seven immatures collected on May 25, 1934 (one to three weeks out of the nest), the first five named were males. Measurements were: length, 221, 213, 208, 206, 201, 201, and

[3]Mrs. Kenneth B. Wetherbee. "Some Measurements and Weights of Live Birds." *Bird-Banding*, Vol. V, 1934, pp. 55-64.
[4]Stevenson, James. "Experiments in the Digestion of Food by Birds." *Wilson Bulletin*, 45:155-167, 1933.

184 millimeters; wing, 117, 116, 112, 108, 108, 105 and 106; tail, 61, 59, 60, 61, 56, 51 and 49; culmen, 20, 20.5, 21, 20.5, 21, 20 and 18. Weight in grams, 86, 80, 77, 76, 72, 69 and 64. Average of the five males, 78.2 grams.

VI. PHYSICAL DEFORMITIES

On account of the great amount of work involved in the banding of more than 30,000 Starlings and the handling of about 8,000 others, and the relatively poor illumination available for the night work, only a part of the birds captured could be examined for external visible physical deformities. Table No. 7 shows the frequency with which each malformation occurred in the 10,000 birds which were most carefully observed by the writer. Doubtless many abnormalities, especially the less conspicuous ones, were overlooked. The frequency of the occurrence of each type can readily be converted into percentage if desired by dividing by 100.

TABLE NO. 7. NUMBER OF PHYSICAL DEFORMITIES PER 10,000 STARLINGS

One Toenail Absent	314	Pigmy Size	6
Two Toenails Absent	210	Tail Missing	1
Three Toenails Absent	163	Swallow Tail	1
Four Toenails Absent	49	Giant Crossed Bill	14
Five Toenails Absent	12	Split Bill	5
Six Toenails Absent	8	Stub Bill	2
Seven Toenails Absent	3	Sparrow-Bill	2
Eight Toenails Absent	1	Grosbeak Bill	1
One Toe Absent	182	Hooked Bill	6
Two Toes Absent	104	Curled Bill	3
Three Toes Absent	68	Transparent Bill	3
Four Toes Absent	28	Chalk Bill	2
Five Toes Absent	3	One Eye Blinded	46
Six Toes Absent	1	Broken or Crooked Wing	6
One Foot Absent	21	One or More White Wing-Feathers	5
One Leg Absent	12	One or More White Tail-Feathers	2
Club Foot	18	Patch of White Body Feathers	4
One Broken or Crooked Leg	83	Total Birds with Abnormalities, 535 or 5.35 per cent of the 10,000	
Both Legs Crooked	6		
Red Legs	3		
Pink Legs	1		
Giant Size	7		

When duplications are eliminated, it is found that 535, or 5.35 per cent, of the 10,000 birds had some physical deformity. About 3.14 per cent lacked toenails, 1.82 per cent lacked toes, .21 per cent lacked feet or legs, .83 per cent had broken legs, .38 per cent had bill deformities, and .46 per cent were blind in one eye. A few of the leg injuries could be traced to the banding activities or the effects of poorly placed bands. A few were traced to disease, infections, or parasites. The remainder

were either inexplicable or presumed to be due to natural causes (injuries and physiological disturbances). Few were of a degree sufficient greatly to affect health or survival as most of the affected birds were not underweight.

Most of the minor leg injuries are believed to be due to the effects of cold and freezing. Birds collected in the field in winter sometimes have large frozen lumps of clay adhering to the toes or legs. Legs may be broken or severed when the birds, in quest of garbage, step into traps set for rodents. Birds with club feet usually have toes or toenails missing, the lower foot being swollen into a diseased lump one-half to three-fourths inch in diameter. Four birds examined seemed to have little or no pigment in the legs. The legs of these were of a red or pink color. In each case both legs were affected but the remainder of the bird was normal.

Seven "giant" birds, appearing normal otherwise, measured 241 to 249 millimeters in length, all being males. (Average length for adult males is 218.2 millimeters. Six "pigmy" birds (five females) measured 189 to 194 millimeters in length. (Average length for adult females is 215.1 millimeters.) Both the giant and pigmy specimens had other measurements and weight in proportion to their unusual lengths. Many birds, of course, were handled which lacked tail-feathers but which had regained them when repeating at a later date. One individual not only lacked any tail-feathers when handled in three different months, but appeared to have the posterior portion of the body shriveled and rounded, being entirely devoid of a tail. One bird had a "swallow tail," the two outer pairs of tail feathers being 19 millimeters longer than the others.

Three birds had bills without pigment and semitransparent. Two had powdery white bills of a chalky nature which could easily be pared away with the fingernail. Six had the upper mandible conspicuously hooked over the lower one. Three had the upper mandible curved upward and backward into a nearly complete loop. Five birds had the upper mandible split into distinct spreading forks, while two others had both mandibles flattened into a small stubby disk. One bill of less than half normal length was shaped and proportioned like the beak of an English Sparrow, while another was thickened and deepened, resembling that of a Cardinal.

Fourteen birds had very curious crossed bills of more than twice normal length. Some of these showed a definite tendency to spiral and most were somewhat split at the tip. All but one had the upper mandible crossing to the left. One bird (band

A-215952—winter 1932–33) was taken on December 3, December 26th, February 2nd, and February 21st, and when caged for several days, experienced no difficulty in partaking of all kinds of foods.

Ohio State University, Columbus, Ohio.

A STUDY OF STARLINGS BANDED AT COLUMBUS, OHIO

By EDWARD S. THOMAS

IN February, 1927, the writer and some companions conceived the idea of capturing and banding flocks of European Starlings (*Sturnus vulgaris vulgaris* Linnæus) at their roosts by means of flashlights. This appears to be the first recorded instance of capturing Starlings by this method in the United States. Over one thousand Starlings were thus banded in 1927 at their roosts in barns in central Ohio, and fifteen hundred were banded in 1928. In 1929, we discovered a large roost of the birds in the towers of the Columbus State Hospital and were successful in capturing over four thousand birds, including 840 repeats and 31 returns from previous years.

The main tower of the State Hospital building was remodeled in 1930, cutting off this fruitful source of supply, but 750 birds were banded in other places. No birds were banded in 1931, but in the last three years the work has been renewed under the direction of L. E. Hicks, until more than thirty thousand Starlings have been banded to date.

Almost the entire membership of the Wheaton Club of Columbus immediately joined in the Starling-banding activities. Although the bands are credited principally to George Wolfram, L. E. Hicks, R. W. Franks, and the writer, the work soon came to be considered a Wheaton Club project.

The present study is based upon a total of 7062 birds banded in 1927, 1928, and 1929 and the returns and recoveries from them up to April 4, 1932. The large amount of material accumulated since that date is being studied by Dr. Hicks with the view of publishing additional papers.[1]

Our technique has not changed materially from that described by the writer in the *Wilson Bulletin* in 1927. Briefly,

[1]See article in this issue of *Bird-banding*.

we ascend to the cupolas or towers by means of ladders, armed with bright flashlights. The bright lights seem to befuddle the birds so that they flutter about in a bewildered manner and are easily captured. They are then lowered in gunny sacks to coöperators waiting below, who band and release the captives.

There were a number of reasons which impelled us to undertake the study of the Starling. The first was an effort to ascertain whether the birds were migratory. At the time the work was begun almost all the available literature agreed that the European Starling was non-migratory in the United States, although given more or less to desultory wandering. Even so recently as 1931, Bissonette (1931, p. 282) makes the statement that the species does not migrate in New England, this belief causing him to make the Starling, as a presumed non-migratory species, subject of experimentation relative to the effect of varying periods of light upon the gonads of the birds, similar to the studies made by Rowan (1931) on those highly migratory species the Junco and the Crow.

We were well aware of the fact that the Starling performed long migrations in continental Europe, though being non-migratory in Great Britain (Wynne-Edwards, 1929), and our observations in the field had convinced us that our birds were migratory.

Furthermore, in 1927 we felt we were witnessing for the first time in America the spread of an introduced migratory species throughout the eastern United States and we believed that the banding of a large number of the birds might shed light on the method of dispersal. We felt, also, that this was a unique opportunity, which might never again be presented, of gaining an insight into some of the underlying principles of that vexing problem, the migratory instinct.

Further, certain undesirable habits of the species had raised the question of the possibility of controlling its numbers, and the first step in the scientific control of an organism is the careful study of its habits and its movements.

From the 7062 banded birds covered in this study we have received 172 recoveries or 2.4 per cent. This is a much lower percentage than may be obtained from some species of birds which are systematically trapped at their nesting or wintering grounds; or from game-birds and birds of prey, the shooting of which is conducive to a high percentage of returns. Our results are closely comparable with those from Starlings banded at Washington, D. C., Kalmbach (1932) reporting 2.6 per cent of returns from 4516 birds banded at that place. Geoffrey Gill, (1931), quotes the Biological Survey to the effect that, of

18,421 Starlings banded in the entire United States up to March 25, 1931, they had received 352 returns or 1.9 per cent.

During 1927 and 1928 the birds banded at their roosts in barns usually deserted and did not return in subsequent years. The birds in the State Hospital towers, however, did not abandon the roosts (as Kalmbach's birds did at Washington), and work at this station on successive years should yield a much higher percentage of returns.

Of our 172 recoveries and returns, 80 of the birds were recovered at a distance of more than twenty miles from the place of banding, and 92 were recaptured within twenty miles. Of the distant recoveries, 52 were recovered outside of Ohio, and 28 within the State. Seventy-six of our local returns consisted of "recaptures"—birds taken at the roosts by our own members at a later date. It is remarkable that there were but 16 birds picked up by other persons locally, as compared with 80 individuals so captured twenty miles or more from the place of banding. At Washington, on the other hand, 70 of the 120 returns were local.

The foregoing data constitute a vindication of our early conviction that the Starling is highly migratory in this region, as is further shown by the accompanying map (Fig. 1). Our most distant recovery to the northeast is from a bird banded by Wolfram at Canal Winchester, thirteen miles southeast of Columbus, on January 10, 1929, which was recovered on March 22, 1930, at St. Marie de Beauce, Quebec, seven hundred miles to the northeast. On the other hand, a bird banded at Columbus on March 17, 1928, was killed in the following December at Merigold, Mississippi, 665 miles to the southwest. If this bird should have nested only 335 miles to the northeast (as our recoveries show that many of them do) it would have performed a migration of not less than one thousand miles.

We had hoped that we should secure some short-time long-distance recoveries which would give an indication of the speed with which the Starling migration takes place. In this, we were only partially successful. A bird banded at Lawrenceburg Junction, Indiana, by C. J. Goetz of Cincinnati on February 19, 1930, was recaptured at Canal Winchester by Wolfram six days later, having made an average of at least 21 miles a day for the 125 miles. Similarly, a bird banded at Columbus on March 8, 1929, was recovered at Avon, New York, 16 days later, having averaged a minimum of 20 miles a day for the 325 miles. These data may be representative of the normal

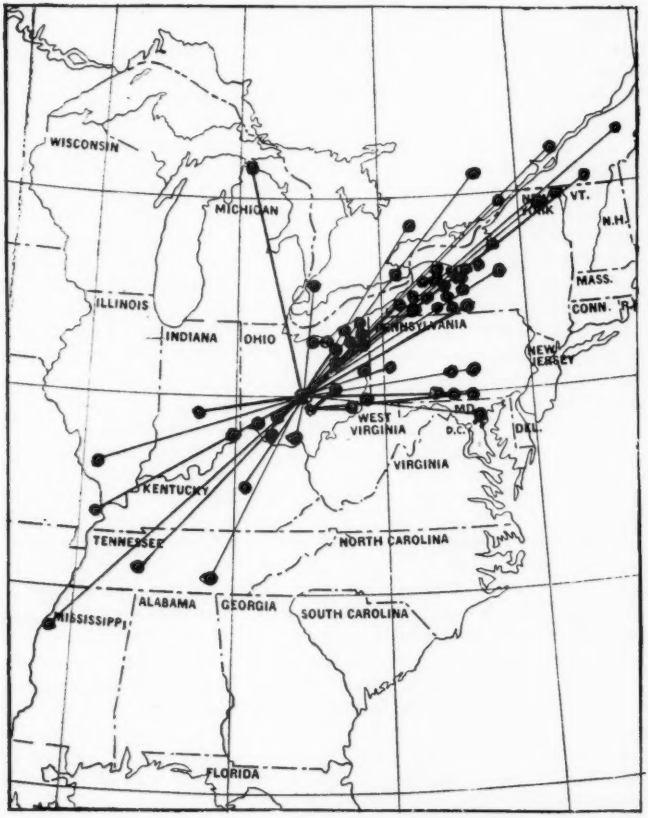

Figure 1. Recoveries of Starlings banded at Columbus, Ohio.

rate of migration. Certainly, however, they do not indicate the great speed in flight of which the Starling is capable.

It is a striking fact that the great majority of Starlings of continental Europe, along with some other species, migrate in a northeast and southwest direction, instead of the conventional north and south migration which is usually associated with migrating birds (Thomson, 1926). This northeast-southwest migration is paralleled in most graphic manner by the Columbus birds.

I feel that it is entirely within the possibilities that the birds introduced into the United States, after maintaining (presumably) a non-migratory existence in New York city for a number of years, later gave expression to the migratory instinct and, further, that this instinct directed them in a northeast-southwest direction similar to that of their European ancestors. While a most plausible theory, and an important one, as concerns the underlying principles of the migratory instinct, it must be confessed, however, that it is far from proved. It should also be noted that the birds banded at Washington, D. C., (Kalmbach *l. c.*) show more nearly a north-and-south direction of flight. Support seems to be lent to the theory, however, by the interesting experiment reported in *Bird-Banding*, where eggs of the non-migratory English Mallards (*Anas p. platyrhynchos*) were transported to Finland, and the birds hatched from them migrated like the Finnish Mallards (Nice, 1934).

It is obvious from our data that many birds which presumably migrated as far southwest as Columbus from northeastern localities have, in subsequent years, wintered far to the northeast. Of 21 December and January returns, 14, or exactly two thirds, were recovered to the northeast of Columbus, while 7 were taken to the southwest. It would thus seem unquestionable that a large number of Starlings, after once having migrated at least as far south as Columbus, fail to do so in some subsequent years, remaining as permanent residents in the north. Similar behavior is shown by Mrs. Nice (1933) to obtain with the Mississippi Song Sparrow (*Melospiza melodia beata*) at Columbus.

This behavior is extremely puzzling. How an individual can be migratory one year and resident the next or *vice versa*, it is difficult to understand on the basis of our present knowledge of bird instinct, particularly the migratory instinct.

Our present theories lead us to believe that migration is brought about by an inflexible instinct, entirely beyond the bird's control and, indeed, without its own consciousness.

Rowan (1931) has produced evidence that in certain species, at least, and under certain conditions, the bird is a complete slave to the varying lengths of daylight as they affect the activity of the gonads. What conditions, then, would cause a species to migrate one year and fail to do so the next? Rowan's theory of varying lengths of daylight seems entirely inadequate to explain this behavior of the Starling, as it is inadequate to explain a number of other phenomena of bird migration.

A study of the gonads of migratory and resident Starlings, nevertheless, might prove enlightening. It is difficult to believe however, that the failure to migrate is due to disease or other physiological defect, in view of the great numbers of Starlings which regularly spend the winter in the Northeast. The age of the individuals, furthermore, does not seem to be a factor, since the proportion of one-, two- and three-year winter recoveries to the northeast and to the southwest are roughly comparable.

Figure 2 shows a map of recoveries taken during the nesting season. The nesting season has rather arbitrarily been fixed at the months of April, May, June, and July. The last month might well be omitted, since the birds do not ordinarily nest in July. Thus, the only record to date not in the northeast-southwest line of flight is that of an individual recovered at Les Cheneaux Islands, Michigan, on July 17th, which very possibly may have nested some distance to the east. Similarly, three of the seven distance recoveries from Ohio were taken in July and may well have been birds which had nested farther to the northeast and which may have already begun their autumnal migration.

The data show conclusively, however, that the great majority of the birds banded at roosts at Columbus nest to the north and east of that locality. Similarly, we have very little definite evidence that many of our nesting birds are permanent residents. We have but 16 local returns (exclusive of recaptures at the roosts) out of our total of 172, and, of these, 7 individuals were recovered shortly after banding, apparently injured during the banding process. Of the remaining nine local returns but four were recovered during April, May, and June, and we have no positive evidence that these did not winter to the south or southwest of Columbus. At any rate, a very small proportion of the birds banded at the large winter roosts at Columbus would seem to be local residents, certainly a much smaller percentage than the 23 per cent estimated by Kalmbach (*loc. cit.*, p. 68) at Washington. Such apparent difference in the behavior of the Starling in different sections of the

United States would seem to make it highly desirable for banders in a number of localities to conduct similar studies.

The foregoing should not necessarily be taken to indicate that none of the central Ohio Starlings are permanent residents. On the contrary, observations seem to indicate that scattered pairs or small groups which roost in barns throughout the area in winter may be birds which also nest in the region. Banding of these individuals would quickly prove or disprove the correctness of this opinion.

The most significant feature of our returns during the nesting season, however, is the fact that not a single one of the first seven thousand banded Starlings has yet been taken more than eight miles southwest of Columbus during the months indicated. This, I believe, provides an answer to the problem of the medium by which the Starling spread throughout the Mississippi Valley.

We have three alternatives: the astonishingly rapid dispersal of the species may have taken place through the agency of (1) birds of the year, (2) the older birds, or (3) both. Our data seem to present convincing evidence that the young of the year were responsible for the dispersal. No banded Starling which has visited as far northeast as Columbus in the spring or winter has yet been taken south or west of Columbus during the nesting season. Or, stated in another manner, no banded bird which has once nested as far northeast as Columbus has yet been proved subsequently to have nested south or west of us. If this is true of the known records of adults, the conclusion seems irresistible that the pioneers which accomplished in so short a time the invasion of the Middle West were birds of the year, which, having scattered to the south and west and having established a nesting territory, never again returned to the northeast. If the adults (and undoubtedly a certain percentage of the young) which migrate through Columbus toward the northeast had subsequently established a residence to the south or west, it would seem certain that the one or more of our seven thousand banded birds would have produced a return from that section of the country.

This conclusion is directly contrary to that of Kalmbach (1928, p. 2), who implies that some of the banded birds at Washington were instrumental in extending the range of the species.

Our conclusion, however, is strictly in accord with previous results obtained by banding other species, which furnish abundant evidence of the tendency of adult birds to return year after year to the same locality to nest, and, on the other

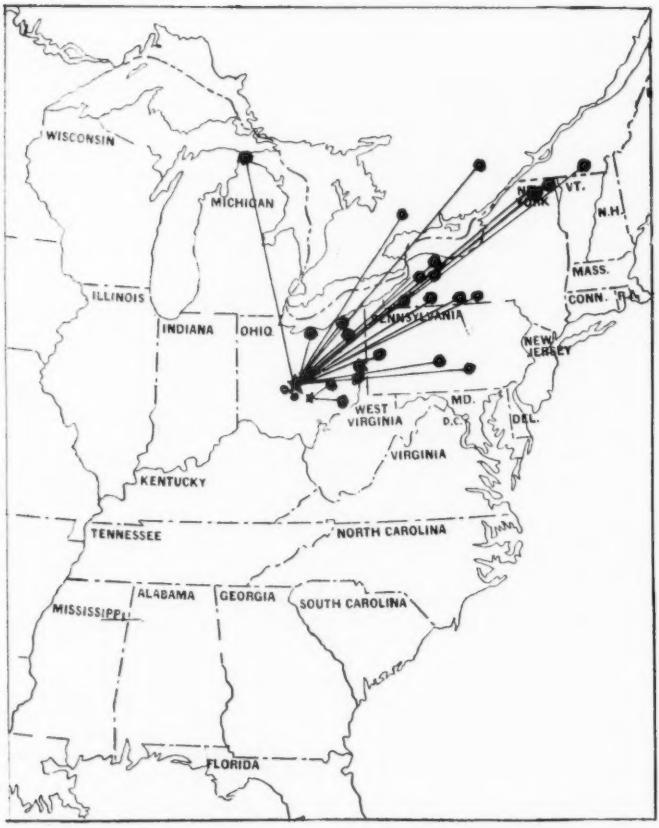

Figure 2. Starling Recoveries during April, May, June and July.

hand, indicate the failure of many of the young of the year to return to their birthplace.

The probable age attained by the Starling, as shown by the returns, has proved of considerable interest. In so sturdy and vigorous a species, one which, in spite of the handicap of normally rearing but one brood a year, has showed such a phenomenal increase in numbers, one might expect to find the individuals relatively long-lived. Such appears not to be the case. Of the returns and recoveries, 67 are birds which were taken less than one year after banding, 67 were returned between one and two years; 19 between two and three years, and but 3 between three and four years. We have waited in vain for a return from a single one of the twenty-five hundred individuals banded in 1927 and 1928 which would indicate that it had lived for four years after banding.

The great majority of our birds have been banded during the height of the migration in late February and early March, when the preceding year's birds would be nine or ten months, or a little less than one year, of age; the adults, of course, at least one year older. It will therefore be seen that many Starlings live to an age of at least three years; a fair number of them attain the age of four years. But the drop in the returns after that age is positively startling. Out of our 172 returns we have but three birds which we can be reasonably certain to have reached the age of five years. This, once more, is confirmation of the evidence adduced by bird-banding, that the average life of birds, especially of passerine birds, is of brief duration. How remarkable it is, then, that the Starling, under this handicap, should nevertheless have been able to increase at such an astonishing rate as to populate in a few short years almost the entire eastern United States!

SUMMARY

1. The European Starlings banded at Columbus, Ohio, are highly migratory.

2. A large portion, if not the great majority of the birds banded at roosts at Columbus nest in northeastern Ohio, Pennsylvania, New York, eastern Ontario, and Quebec.

3. Many of them winter to the southwest of Columbus, one of them at least, as far as Merigold, Mississippi.

4. The evidence indicates that a very small percentage of the birds banded at the large roosts at Columbus are permanent residents.

5. The individuals passing through Columbus migrate in a northeast-southwest direction, closely paralleling the direction of flight of the species in continental Europe.

6. The evidence indicates that the dispersal of the species throughout the Middle West took place through the medium of the birds-of-the-year and not by the subsequent dispersal of adults which had previously nested to the northeast.

7. Many Starlings apparently migrate one year and fail to do so in other years. The underlying causes of this behavior are difficult to explain.

8. The returns indicate that a very small proportion of Starlings attain an age of five years, though a fair number reach an age of four and many attain the age of three years.

TABLE OF ESPECIALLY INTERESTING RECOVERIES

Number	*Where Banded*	*Date Banded*	*Where Recovered*	*Date Recovered*
400659	Columbus, O.	Feb. 26, '27	Dublin, O.	May 4, '27
483077	"	March 4, '27	Columbus,[2]	Dec. 22, '27
"	"	"	"	Feb. 29, '28
483392	"	March 12, '27	Franklin, Ind.	Jan. 3, '28
483294	"	March 11, '27	Charleston, Mo.	Jan. 28, '28
474556	"	Feb. 26, '27	Dunkirk, N. Y.	March 5, '28
625377	Hooker, O.	March 3, '28	Bedford, Pa.	March 24, '28
483911	Columbus, O.	Jan. 14, '28	Brunswick, O.	May 15, '28
625091	"	Feb. 29, '28	Circleville, O.	May 31, '28
426438	"	March 2, '27	Wilmington, O.	Feb. 12, '28
625520	Hooker, O.	March 3, '28	Dresden, O.	June 25, '28
625829	Columbus, O.	March 17, '28	Grove City, O.	May 15, '28
483870	"	Jan. 14, '28	Les Cheneaux Islands, Mich.	July 17, '28
625667	Hooker, O.	March 3, '28	Macksburg, O.	June 3, '28
625170	Columbus, O.	Feb. 29, '28	Elmira, N. Y.	Sept. 30, '28
625736	"	March 17, '28	Merigold, Miss.	Dec. 13, '28
483167	"	March 4, '27	Lakeville, O.	Jan. 7, '29
474592	"	Feb. 26, '27	Delaware, O.	Jan. 7, '29
483986	"	Jan. 4, '28	Strathroy, Ont.	Dec. 1, '28
A204337	Canal Winchester, O.	Jan. 10, '29	Moundsville, W. Va.	Dec. 17, '29
A204256	"	"	Three Rivers, Can.	Dec. 21, '29
A204239	"	"	Manchester, O.	Jan. 29, '30
641264	"	"	Lawrenceburg Jct., Ind.	Feb. 19, '30
641263	"	"	Brockville, Ont.	Feb. 23, '30
A204504	"	"	Ste. Marie de Beauce, Que.	March 22, '30
A204218	"	"	Humberstone, Ont.	Feb. 25, '30
A209594	Columbus, O.	March 6, '29	Beardstown, Tenn.	Nov. 6, '29
A209766	"	"	Waterfall, Pa.	March 23, '29
A212967	"	Feb. 16, '29	Willard, N. Y.	Jan. 12, '30
A213376	"	"	Martville, N. Y.	Jan. 20, '30
A213988	"	Feb. 28, '29	Oneida, N. Y.	Jan. 18, '30
A213557	"	Feb. 16, '29	Simcoe, Ont.	Jan. 22, '30
625585	Hooker, O.	March 3, '28	Interlaken, N. Y.	Jan. 27, '31
640046	Columbus, O.	March 8, '29	Bluff Point, N. Y.	March 7, '31
A304761	"	March 9, '29	Thornville, O.	Jan. 18, '31
A213578	"	Feb. 16, '29	Baltimore, Md.	Jan. 15, '32
483364	"	March 12, '27	Corunna, Ont.	Jan. 2, '31
625103	"	Feb. 29, '28	Bath, N. Y.	Feb. 21, '29
483142	"	March 4, '27	Falconer, N. Y.	Feb. 23, '29
625992	"	March 17, '28	Ashtabula, O.	Feb. 12, '29
400697	"	March 4, '27	Holmesville, O.	Feb. 25, '29
A213163	"	March 8, '29	Cincinnati, O.	Feb. 12, '30
A304101	"	March 8, '29	Roseville, O.	Feb. 4, '30
625162	"	Feb. 29, '28	Warsaw, O.	Feb. 27, '30
A304288	"	March 9, '29	Jefferson, O.	Feb. 28, '30
625134	"	Feb. 29, '28	Bohon, Ky.	Feb. 16, '29
A213714	"	Feb. 16, '29	Pierrepont Manor, N. Y.	Feb. 13, '32
625976	"	March 17, '28	Perry, N. Y.	Feb. 10, '31

[2]A return.

A250674	Lawrenceburg Jct., Ind.	Feb. 19, '30	Canal Winchester, O.	Feb.	27, '30
A304115	Columbus, O.	March 8, '29	Avon, N. Y.	March	24, '29
A212498	"	Feb. 16, '29	Victor, N. Y.	March	27, '30
483962	"	Jan. 14, '28	Otto, N. Y.	March	11, '30
A213978	"	Feb. 18, '29	Butler, Co. Pa.	March	5, '30
625818	"	March 17, '28	Belleville, Ill.	March	15, '29
A212859	"	Feb. 28, '29	Rochester, N. Y.	March	6, '31
A213403	"	Feb. 16, '29	Cincinnati, O.	March	2, '31
437473	"	March 6, '29	Friendship, N. Y.	Apr.	6, '29
483488	"	Dec. 22, '27	Malone, N. Y.	Apr.	28, '30
A212989	"	Feb. 16, '29	Chazy, N. Y.	May	5, '29
A212819	"	Feb. 28, '29	Albion, N. Y.	May	19, '29
A304063	"	March 8, '29	Conewango, N. Y.	May	24, '30
A304791	"	March 9, '29	Batavia, N. Y.	May	5, '29
625274	"	Feb. 29, '28	Duncannon, Pa.	May	28, '30
625594	Hooker, O.	March 3, '28	West Brome, Que.	May	14, '30
A212985	Columbus, O.	Feb. 16, '29	Millport, N. Y.	June	3, '30
A304186	"	March 8, '29	Rosenthal, Ont.	June	5, '29
A304516	"	March 9, '29	Ontario, Co., Ont.	June	17, '29
A304577	"	March 9, '29	Butler Co., Pa.	June	9, '31
A304558	"	March 9, '29	Columbiana, O.	July	11, '30
A304133	"	March 8, '29	"	July	4, '30
A304279	"	March 9, '29	Berlin Hts., O.	July	14, '31
A304259	"	March 8, '29	Johnstown, O.	Sept.	21, '29
625973	"	March 17, '28	Spangler, Pa.	Oct.	26, '28
483383	"	March 12, '27	Baltimore, O.	Nov.	4, '29
400641	"	Feb. 26, '27	Indianapolis, Ind.	Nov.	8, '29
A304375	"	March 9, '29	Dansville, N. Y.	Dec.	31, '29
A304269	"	March 8, '29	Huron, O.	Dec.	9, '29
A213295	"	Feb. 16, '29	Portsmouth, O.	Dec.	11, '29
A304747	"	March 9, '29	Warren, O.	Dec.	12, '29
A213755	"	Feb. 16, '29	Bellbuckle, Tenn.	Dec.	31, '29

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MIDWINTER BANDING OF EASTERN SNOW BUNTINGS, LAPLAND LONGSPURS, AND HORNED LARKS IN NORTH DAKOTA

By C. E. BOARDMAN[1]

To those of us who live within the wintering range of Snow Buntings and Lapland Longspurs, the banding of these birds opens up a new field for study. From my experience this winter (1933–34) it would seem that the reason so few of these two species have been banded is because little effort has been made to do so.

Snow Buntings (*Plectrophenax n. nivalis*) appeared on our farm early in November with the first heavy fall of snow. On December 17th, when there was only a little snow on the ground, Glen Berner, another bander, and I banded over seventy of them. The snow disappeared shortly afterwards, and with its disappearance the Snow Buntings disappeared also. More snow came on the 22d and the Buntings returned. We placed our four drop-traps in a burned-over wheat-field, in different situations, and far enough apart to prevent the pulling of one from disturbing the birds at the other traps, and ran long strings to a central point where we could park a car. Two weeks from the time we caught our first Snow Bunting we had banded over a thousand. Christmas week was very cold, but the banding was good. We found that in cold, rough weather the birds came most readily to our traps. We accordingly operated them from a heated automobile and did our banding inside the car, often with an outside temperature as low as 10° to 20° below zero.

In January another warm period again carried off the snow, and, as before, the Bunting disappeared, moving presumably to a snow-covered territory. On February 20th, however, although there came a slight snowfall of about an inch, no Snow Buntings returned. In their place an abundance of Lapland Longspurs (*Calcarius l. lapponicus*) appeared on their northern migration. On February 22d, Mr. Berner spent the entire day at the traps, and banded three hundred and nine birds, all Longspurs except about fifteen Horned Larks. The

[1] Word has been received from Mr. O. A. Stevens, of Fargo, North Dakota, that Mr. Boardman died on June 18th. *Bird-Banding* has lost a zealous worker and his passing brings to a close a most promising investigation of northern birds in winter time on a scale not previously attempted. *Editor.*

following Sunday he banded two hundred and eighty more. On three trips to the traps I banded five hundred and ten. As with the Snow Buntings, we found it necessary to have the ground covered with snow to get the Longspurs and Horned Larks to go under the traps.

We could positively connect the presence of Snow Buntings with the occurrence of snow on the ground, and we found that they left if the snow melted, only to return with the next storm. Any evening during a fall of snow, the calls of these birds could be heard as they flew over Jamestown in the dark. I think this is because they become confused by the street lights.

One evening on leaving the trapping-grounds we found the Snow Buntings evidently bedded down for the night, but instead of being in weed-patches, where we supposed they would be, we found them scattered over a plowed field. They were in holes dug in the little patches of snow on the lee side of clumps of dirt and they were partially covered. On approach they flushed one by one. They were tucked in about four feet apart, as if for the protection of the flock, since no marauder could have captured more than one bird without giving the alarm. Mr. Berner also observed them thus bedded in on another occasion.

On very severe days we have also seen them lie on their sides while feeding, their feet drawn up in their feathers to avoid freezing them, and on such days it was difficult to get their feet out of their feathers in order to place the bands. During such cold weather, we noted that the Buntings dig holes in the snow and lie in them on their sides, and always on or in drifts with southern exposures and in the open away from weed-patches. The Snow Buntings seem to do the most persistent feeding in the middle of the day, say from 10 A.M. until 2 P.M. It is not much use to try to trap later than 3 P.M. during the short days.

We operated on a burned-over uncut wheat-field adjoining a plowed field, having scattered gravel hillocks. On the burned-over section there would be patches of several acres of standing wheat that the fire had not destroyed. These places were a great attraction for the large flocks of Snow Buntings, and, after they had left, the Longspurs were equally attracted by them. From these large flocks of Buntings in the standing grain small bands would break away to feed at the traps. We often found Snow Buntings, Lapland Longspurs, and Horned Larks intermingled, so that we captured all three species together.

In selecting a place to trap the above species, I would suggest a burned-over stubble-field near to where a car can be

parked, or, of course, at any place these birds frequent, and traps should be permanently placed and baited. We have used a six-feet-square drop-trap with great success, taking as many as eighty-five birds at one pull. If birds are handled in large numbers, several gathering-cages are necessary to remove them quickly. We have had no casualties with this trap. At one time we were working on a flock that we estimated at ten thou sandbirds, and we probably banded at least ten per cent of them. Notwithstanding the large number of Buntings banded, 1,285, we did not get over six repeats during the winter, one bird recaptured the following day, and the other five recaptured the same day. In the case of Longspurs, repeats were much more frequent. We both found with regret that we were unable to make the distinctions necessary to determine the sexes or races of the Horned Larks, but I am satisfied the birds were the Prairie race, *Otocoris alpestris praticola*.

Regarding the winter-time habits of Snow Buntings, Forbush[1] writes that "when the snow is soft, these birds (Snow Buntings) are said to dive into it . . . and there pass the night," also that "when the snow is frozen hard, the flocks sleep in the open, protected from the north wind by some slight rise in the ground . . .", and that they are forced southward in severe winters when deep snow covers the north country.

Our observations show that the species also often enters the snow-banks during the day. This was noticeable during old, sub-zero weather, and particularly if a strong wind blew. Often a dozen or more birds congregate on a bank, and within a few inches of one another. We were able to watch them in a snow-bank close to our car, and it was observed that they not only used the snow for protection but for "dusting," as grouse dust in summer. After the birds were gone, and the ground was nearly bare with only a few drifts about, these pit marks could be seen in most any remaining drifts.

We banded a total of 2648 birds—1490 banded by me and 1158 by Mr. Berner. The details follow:

Period	*Snow Buntings*	*Horned Larks*	*Lapland Longspurs*
Dec. 15th to Dec. 31st	509	93	20
Jan. 1st to Jan. 14th	731	123	17
Jan. 28th to Feb. 27th	45	36	1074
Totals	1285	252	1111

Jamestown, North Dakota, March, 1934.

[1] Birds of Massachusetts and Other New England States, Vol. II, pp. 33–36.

GENERAL NOTES

Two Pairs of Mockingbirds Remate for the Second Year.—Two male Mockingbirds (*Mimus polyglottos polyglottos*) are definitely known to have been residents of our gardens since 1931, when banding operations were begun, each occupying his own territory, one east, the other west, of our house. Late in 1932 they were banded with colored bands for life-history studies. In the spring of 1933, after numerous visiting females had been courted, both birds finally mated early in April. The females were also banded at that time with both numbered and colored bands. Each pair successfully reared two broods. The mate of Mockingbird Y, banded yellow, disappeared late in the summer, presumably migrating, but the mate of B, banded blue, remained at the banding station through the winter until February 13th or 14th, 1934, when she disappeared. However, on March 6th she returned and mated with B for the second year. On March 18, 1934, the former mate of the other resident Mockingbird, Y, arrived with plumage not darkened by soot like the wintering birds. She also immediately joined her former mate. Both females have been trapped for verification of the sight identifications. Both are now (May 21st) brooding their second nests of this year, the young of the early nests having been destroyed by predatory creatures.—AMELIA R. LASKEY, Graybar Lane, Nashville, Tennessee, May 21, 1934.

Return of Banded Adult European Cormorant (*Phalacrocorax carbo carbo*) **to its Native Colony.**—The accompanying photograph of a

Adult European Cormorant, banded as a juvenile, which returned to its natal colony, Lake Island, Saguenay County, Quebec, July 20, 1933.
Photograph by Harrison F. Lewis

banded adult European Cormorant was taken at the nesting colony of this species on Lake Island, Saguenay County, Quebec, on July 20, 1933. The bird appeared to be fully adult and had therefore been a nestling in some year prior to 1932. Evidently it was banded when a nestling, at the colony where it was photographed, for the records of the Bureau of Biological Survey show that all birds of this species banded in North America have been banded as birds of the year and that, prior to 1932, none of them were banded elsewhere than at Lake Island.

Thus we now have photographic evidence of the return of an individual of this species, when adult, to the colony in which it was hatched. Presumably it was breeding in the Lake Island colony in 1933. I have previously published a record of a similar occurrence in connection with which no photograph was obtained. (*Bird-Banding*, Vol. 2: 33 and 128.)

The founding, in 1930, of a small new colony of European Cormorants in St. Mary Islands Bird Sanctuary, twenty miles northeast of the Lake Island colony, shows that birds of this species do not always return to nest in the colony in which they were hatched.—HARRISON F. LEWIS.

Brown Thrasher Banding Records from Nashville, Tennessee.—The following tabulations record the number of Brown Thrashers (*Toxostoma rufum*) banded at my stations in Nashville, Tennessee, as well as the returns and recoveries. All but two were banded between the dates of March 14th and October 5th and migrated for the winter, two being recovered.

Total banded (from August 8, 1931 to April 21, 1934)	191
Individuals returning to place of banding	15
Recoveries	2
Local recoveries (within two months of banding)	4
Total number heard from (11 per cent)	21

RETURNS

Band No.	*Banded*	*Returns-1*	*Returns-2*	*Returns-3*
A280725	Aug. 13, 1931	March 28, 1932		
**A280729	Aug. 30, 1931	Apr. 10, 1932	Apr. 7, 1933	Apr. 21, 1934
*A292720	March 31, 1932	Apr. 11, 1934		
A292725	Apr. 18, 1932	June 9, 1933		
*B202538	June 18, 1932	March 22, 1933		
*B202544	June 20, 1932	Apr. 21, 1933		
*B202567	June 27, 1932	Apr. 26, 1933		
*B202568	June 27, 1932	March 27, 1933		
B202597	July 30, 1932	June 9, 1933	June 6, 1934	
**B216058	Sept. 17, 1932	May 17, 1933	March 28, 1934	
B216063	Sept. 18, 1932	Apr. 27, 1933		
B234891	March 14, 1933	May 17, 1934		
*B234905	Apr. 11, 1933	Apr. 8, 1934		
B252931	June 20, 1933	March 20, 1934		
*B252947	June 23, 1933	March 30, 1934		

*Banded at substations.
**Presumably males: singers, longer primaries.

RECOVERIES

Band No.	*Banded*		
A292726	Apr. 21, 1932	Jan. 16, 1933	Reported dead, Cypress, La.
B216041	Sept. 15, 1932	Oct. 26, 1932	Reported killed, Fayette, Ala.
B218537	Sept. 2, 1932	June 24, 1933	Taken at my home station. By Mrs. A. Cochran, two miles southwest.

The first records of Brown Thrashers wintering in the Nashville area were obtained in 1933–34, two being banded with both numbered and colored bands. One, at the home of Jack Calhoun, is known to have remained there for nesting this spring, mating with B252947, a return–1. AMELIA R. LASKEY, Nashville, Tennessee.

Tree Swallow Tragedies.—As the 1933 breeding season of Tree Swallows (*Iridoprocne bicolor*) at my banding station was marked with a series of unusual tragedies, the following notes on the destructive behavior of two females have been prepared. For convenience these are referred to as "No. 2" and H49344, the latter an adult female mated to an immature bird (a return–1) which were nesting by late April in Box 5. On May 3d an immature female (No. 2) appeared. She was almost constantly about the boxes, unattended by a mate. Then about mid-May she and F60913 disappeared when H49344 was sitting on eggs, and they did not reappear until June 10th, when H49344 had young which she was feeding alone. At some time in the afternoon of the 10th, Bird 2 visited Box 8 in the adult's absence and killed five young by striking them at the posterior corner of or just above the eye, probably doing this when the young lifted their heads to be fed.

In the late afternoon of the 12th, it was also found that Bird 2's forenoon visits to Box 1 had resulted in another tragedy: The young had been killed and pulled from the nest and the female, F41555 (mother of F60913), had fought Bird 2 in the box and had experienced the worst of the fray, the torn-up nest holding some of her tail feathers, many fine body feathers, and the white-duck nest-lining feathers were blood-spattered.

It was also observed, in the forenoon of the 12th, that, having been set upon numerous times by the birds at Boxes 2 and 4 and Substation D when Bird 2 went to them, No. 2 attacked H49344 while brooding her young in Box 5; and in the following fight many feathers were torn loose from both birds, including all but the right outer tail-feathers from H49344. On the 13th, H49344 was at her nest-box. At intervals during the day she looked in without entering or feeding, and on these visits she was seen to kill three of her five young. This was accomplished in practically the same manner that Bird 2 adopted, by striking several blows near the center of the crown when the young raised their heads, crushing one skull badly. The remaining two young were at this time too weak to lift their heads. Bird 2 was not present at the station the 13th or 14th.

On the morning of the 15th, Bird 2 was proving to be extremely troublesome at Boxes 2 and 4. She was often at Box 5 with F60913 and made her raids on the young from there. F60913 was never known to accompany her on her raids. On the morning of the 16th, Bird 2 made intermittent visits to Substation D, where she also became troublesome. Late in the afternoon, taking advantage of both birds being away at the same time, Bird 2 succeeded in dodging into Substation D box and, before we were aware of the fact and of her intentions or could intercept her, had killed five more young in the same manner she killed the other eleven.

Late in the afternoon of June 17th just before dusk, Bird 2 found opportunity to enter and kill the six young at Box 4, when they were nearly grown, the adults having finished feeding for the day and apparently having gone to roost for the night.

It was on the 18th, too, that Bird 2 visited Substation B during the rain of early morning, and, again by blows on the head, killed three more young. —Lewis O. Shelley, East Westmoreland, New Hampshire.

If a like number of people were killed by a human being, a motive would be looked for, but it would probably be found that the perpetrator was insane. Are we justified in explaining the behavior of these birds in the same manner?—Editor.

White-crowned and Gambel's Sparrow Returns.—White-crowned Sparrows have been trapped at my home banding station between the dates of October 15th and May 15th, some apparently as transients en route south in the fall and again on the way north in the spring, as indicated by repeat records. However, each of the two full seasons that this species has been trapped, a total of five hundred repeat records indicate that about fifteen individuals, immatures predominating, have wintered about the banding station, acquiring the black and white crowns of adult plumage in April and May just prior to migrating.

From February 1, 1932, to May 9, 1934, a total of one hundred and thirty-one White-crowned sparrows were captured,[1] two of which were of the subspecies *gambeli*. It might be interesting to note that my very first White-crowned Sparrow (captured and banded February 1, 1932) proved to be an adult Gambel's sparrow which I failed to recognize that first season. This bird, B176049, apparently spends January, February, and early March at the station, for during three seasons it has been retaken several times during these months, in spite of the fact that it was kept each season for an hour or two for observation, this being the first Gambel's sparrow recorded in Tennessee.

RETURNS

Band No.	*Banded*	*Returns-1*	*Returns-2*
Gambel's Sparrow (*Zonotrichia leucophrys gambeli*)			
B176049ad.	Feb. 1, 1932	Jan. 21, 1933	Feb. 20, 1934
White-crowned Sparrow (*Zonotrichia leucophrys leucophrys*)			
B176054 im.	March 1, 1932	Nov. 9, 1932	Nov. 11, 1933
B176057 ad.	March 5, 1932	Nov. 7, 1932 (Casualty)	Dec. 27, 1932
B176066 ad.	March 23, 1932	Dec. 26, 1932	Jan. 31, 1934
B176071 im.	Apr. 2, 1932	Jan. 28, 1933	
B176074 im.	Apr. 6, 1932	March 20, 1933	

The following White-crowned Sparrow records indicate probable migration stops at my station: C186950 (immature), banded Nov. 19, 1933, repeated Nov. 19, Nov. 22, 1933 and April 18, 1934; C186955 (immature) banded Nov. 22, 1933, repeated Nov. 22 and 29, 1933, April 12 and April 17, 1934.—Amelia R. Laskey, Nashville, Tennessee.

A Black-throated Green Warbler Recovery.—The first recovery of a warbler banded at this station is that of a female Black-throated Green which was taken in a water-drip trap May 24, 1933, and was "caught" at West Memphis, Arkansas, on October 22, 1933, and died two days later. West Memphis, situated on the west bank of the Mississippi, is approximately 1150 miles distant "as the crow flies" from Groton, and, as might be expected, is in the line of flight for birds taking the direct course to southern Texas and Mexico.—William P. Wharton, Groton, Mass.

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[1] Accounts of the discovery of *gambeli* wintering in Tennessee have been published previously by Mrs. Laskey—in *The Auk*, Vol. LI, 1934, pp. 245, 246, and in the *Journal of the Tennessee Academy of Science*, Vol. IX, No. 2, 1934, p. 119.—Editor.

Banding Tree Sparrows.—I received my banding permit in the fall of 1932 and I was ready to trap the first Tree Sparrow arrivals on November 9th. A total of eighty-one were banded during that winter, the last unbanded bird being caught on April 15, 1933, and a few repeated as late as May 1st.

During the 1933–34 season, I banded a total of two hundred and fifty-three birds and had eighteen returns of those banded last year, or 22.22 per cent. The large increase in birds banded this season over last is due partially to more equipment and time, but principally, I believe, to the severe winter we had. I find that when the weather is very bad the birds come in large numbers to the station for protection and easily acquired food. They remain with us until the stormy weather subsides and then scatter around in the near-by vicinity, although, of course, some of the birds stay close to the station from the time of their arrival in the fall until they depart the following spring. On February 26th, a very disagreeable day when snow fell continuously, the thermometer registering from 20° to 27°, we banded eighteen birds and handled forty-two different birds sixty-three times, not counting some that escaped while others were being taken from the traps. All of these except two were Tree Sparrows. I also found that the Tree Sparrows this season arrived earlier (November 4th) than last year and departed later. An unbanded one was caught May 1st and a repeat as late as the 7th.

By operating a substation in the woods two blocks from my regular station, I find that there is a daily movement among some individuals; some will be trapped here in the morning and in the afternoon at the substation, and the following day be back at the station again, and so on. Other birds stay around the station permanently from their arrival until their spring departure, repeating every few days or several times a day. The list of returns follows:

TREE SPARROW RETURNS

Band No.	*Date Banded*	*Date Returned*	*Remarks*
C163833	Nov. 9, 1932	Nov. 11, 1933	A return-2
34	" 11, 1932	" 9, 1933	(A return-1,
C165878	" 13, 1932	Dec. 27, 1933	March 25, 1933)
79	" 14, 1932	Nov. 19, 1933	
83	" 28, 1932	" 12, 1933	
84	" 29, 1932	March 30, 1933	
85	Dec. 5, 1932	Nov. 11, 1933	
86	" 7, 1932	" 24, 1933	
88	" 14, 1932	" 10, 1933	
95	" 23, 1932	" 19, 1933	
C171611	Jan. 10, 1933	" 27, 1933	
21	Feb. 12, 1933	" 18, 1933	
22	" 12, 1933	Dec. 12, 1933	
26	" 14, 1933	Feb. 3, 1934	
28	" 15, 1933	March 16, 1934	
34	" 18, 1933	Dec. 23, 1933	
C185353	March 5, 1933	Jan. 5, 1934	
57	" 17, 1933	Apr. 3, 1934	
85	" 27, 1933	Jan. 5, 1934	

C165883–85–86–88 and 95 were all frequent repeaters and my records show that they often travelled in one another's company or as a group. Next season I plan to use colored bands to obtain more specific data on individual birds.—GUSTAVE DOMITZ, JR., Pequannock, New Jersey.

RECENT LITERATURE

(Reviews by Margaret M. Nice)

MIGRATION STUDIES

Schildmacher's Experiments on the Physiology of Migration.—The first report of H. Schildmacher[1-4] (reviewed in *Bird-Banding*, 1933, p. 163) on his experiments at Helgoland was criticized by G. Steinbacher[3] and E. Stresemann,[4] largely on the ground that there had been no controls. In the present paper[2] this defect has been remedied to some extent, since five birds were used as controls with ten as experimentals. The subjects—female Redstarts (*Phœnicurus phœnicurus*) were kept in cages that registered the activity of the inmates; after all had shown the "migration restlessness" (*Zugunruhe*) for several nights, the experimentals had various amounts of the female hormone—progynon—injected into their breast muscles, while the controls (in the 1933 tests) were treated in the same way with normal salt solution. In the 1932 experiments, after a certain number of moderate doses of progynon the birds showed a marked reduction or complete loss of the restlessness, but large doses had no effect. Late in the season larger doses were needed in order to quiet the birds than early in the fall.

Schildmacher's theory is that "the variations in the inner secretions of the gonad constitute a link in the chain that starts the fall migration impulse" (2 : 88). He believes that fall migration is activated by a decreasing amount of sex-hormone secretion; when a moderate amount is injected, the bird is brought back to the resting stage of summer, but when a large amount is added, the bird is thrown into the condition of a spring migrant, the stimulus at this time coming from an increasing amount of sex hormone.

In the 1933 experiments eight young birds were caught between August 24th and 26th and injected from September 4th to 15th; the four controls showed no dimunition of restlessness, nor did the experimentals. The author decides that the dosage of 20 mouse units must have been too high. Seven other young birds were caught September 6th and 7th; one was injected with salt solution from September 25th to October 5th, and showed no lessening of restlessness. The others were given from 5 to 30 mouse units of progynon from September 21st to October 4th; all reacted with a decrease or disappearance of restlessness, low doses bringing no results, but 15 mouse units having an effect after six days, and higher doses sometimes more quickly.

It appears to the reviewer that these studies give inconsistent results, and that many more experiments with both treated and untreated birds should be carried out.

Stresemann, in commenting upon Rowan's and Schildmacher's hypothesis of the relationship between the gonads and migration, points out that if this were true, no species should begin migration with fully developed sex glands. But very late migrating species like the Rose-colored Starling (*Pastor roseus*) and some Asiatic Plovers remain in winter quarters

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[1] 1933. Zur Physiologie des Zugtriebes. I. Versuche mit weiblichem Sexualhormon. *Vogelzug*, 4, 21–24.

[2] 1933. Weibliches Sexualhormon und Vogelzug. *Ornithologische Monatsberichte*, 41, 82–84.

[4] 1933. Aves. In *Handbuch der Zoologie*. Bd. 7, 2. Halfte, 697–698.

[2] 1934. Ibid. II. Weitere Versuche mit weiblichem Sexualhormon. *Vogelzug*, 5, 1–9.

until their testes are "almost to full breeding size," while with ducks the testes begin to enlarge in November, several months before the beginning of spring migration. On the other hand, the gonads of early migrants are still very small at the start of migration. "Finally Rowan leaves entirely out of account the behavior of *young birds of many species*, that in spite of gonads of minimal development and stationary condition, are particularly subject to the urge to wander" (4 : 698).

Migration and the Wind.[5]—The author distinguishes between birds that prefer to migrate against the wind and those that like to fly with it, calling the first positively anemotropic and the second negatively anemotropic. By a series of charts giving a "guide-line," *i.e.*, a coast-line which the birds are following, and six possible winds, he shows the resulting direction of migration in positively anemotropic birds, two of them proving to be *cursus retroversus*, for the birds are mistakenly migrating in exactly the wrong direction.

The "Homing Instinct," Winter Territory and Individual Flight Lines. E. L. Sumner, Sr. 1933. *News from the Bird-Banders*, 8, 40–43.—A résumé of several papers on this subject published in *The Condor*, and an account of some of the author's own experiments in transporting Golden-crowned Sparrows.

Experiments on Distant Orientation in the Starling.[6]—W. Schein at the suggestion of the Vogelwarte Rossitten has carried out some very interesting experiments on homing with nesting Starlings, sending them by train to other towns. Of thirteen Starlings transported eleven miles, eight returned; a female Black Redstart (*Phœnicurus ochrurus gibraltariensis*) and a pair of Swallows (*Hirundo rustica*) all returned from the same distance. Of eleven Starlings sent sixty-eight miles seven returned; of six sent 123 miles two returned. The Starlings were watered and fed mealworms before the journeys. Some of the birds were given red bands, but if each had been distinctively marked with colored bands, identification would have been facilitated. When a female Starling was taken from a nest the male would care faithfully for the eggs for three to five hours, but after that leave for food and to sing outside. If his mate failed to return on the second or third day, he would throw out the eggs and carry green leaves each day into the nest.

Do Wandering Titmice have a Homing Instinct?[7]—Data are given on all German and Swiss recoveries of Great Tits (*Parus major*) and Blue Tits (*Parus cæruleus*) fifteen miles or more from the place of banding, and the results charted according to time of year banded and season recovered. A number have been found in the breeding season from 35 to 180 miles from where they had been ringed during a previous breeding season. The author

[5] Koch, J. C. 1934. Vogelzug unter Einfluss von Leitlinie und Windrichtung. *Vogelzug*, 5, 45–52.

[6] Rüppell, W. 1934. Versuche zur Ortstreue und Fernorientierung der Vögel. II. Verfrachtungsversuche am Star (*Sturnus vulgaris*) u. a. Arten von W. Schein—Winsen. *Vogelzug*, 5, 53–59.

[7] Ruppell, W. 1934. Sind wandernde Meisen ortstreau? *Vogelzug*, 5, 60–66.

suggests that in species that are predominantly stationary those few individuals that "wander" do not make true migrations, for the homing instinct is probably undeveloped.

BANDING STATIONS IN FOREIGN COUNTRIES

Banding in Switzerland.—Herr A. Schifferli's[8-12] reports are always full of interest; he tells of the needs of the Station and the acquisitions of the visitors to Sempach, and of his own visits to Dr. Duse at the Osservatorio Ornitologico del Garda at Salò. For 1932 thirty-three coöperators are listed as banding from one hundred to two thousand birds each, the total for the year reaching 15,484. Returns and recoveries are reported briefly and clearly, the distance and direction from the place of banding being given. Particularly helpful are the comments, discussing the findings under each species and calling attention to the results of greatest importance. The Swiss are interested primarily in migration, rather than life-history studies. They use traps and also nets for capturing their subjects.

Starlings banded in the nest return to their birthplace, and the same is true of the Alpine Swift (*Micropus melba melba*). During a great snow in March, 1931, some Starlings made a return migration (11:75). A male Greenfinch (*Chloris chloris*) banded in Switzerland January 29, 1930, was taken the next winter, Feburary 22, 1931, in southern France (11: 77). A male Mallard (*Anas platyrhynchos*) banded on Lake Luzern December, 1928, was taken in June, 1931, in northern Russia two thousand miles northeast (12 : 107). The following records of longevity are of interest: a Marsh Titmouse (*Parus palustris communis*) (8: 7) and a Great Tit of six years (12 : 104); a Sparrow Hawk (*Accipiter nisus*) of nearly seven years (12: 107); and a Common Buzzard (*Buteo buteo buteo*) (12 : 106) and an Alpine Swift (11: 80) of nine years.

Banding in Holland.—Ringing in Holland was started in 1911 under the leadership of Dr. E. D. van Oort, director of the National Museum of Natural History at Leiden; each year a handsome report[13-18] is published on the returns and recoveries. By 1930 over one hundred thousand birds had been ringed, but the later pamphlets make no mention of numbers of birds ringed or recovered, nor is there any emphasis on especially significant results.

[8] 1928. 4. Bericht der Schweizerischen Vogelwarte Sempach (1927). *Der Ornithologische Beobachter*, 26, 1–10.

[9] 1929. 5. Bericht über die Schweizerische Vogelwarte Sempach (1928). *Ibid*, 27, 2–14.

[10] 1932. 7. Bericht der Schweizerischen Vogelwarte Sempach (1930). *Ibid*, 29, 66–84. For review see *Bird-Banding*, 4, 117, 1933.

[11] 1933. 8. Bericht der Schweizerischen Vogelwarte Sempach (1931). *Ibid*, 30, 66–86.

[12] 1934. 9. Bericht der Schweizerischen Vogelwarte Sempach (1932). *Ibid*, 31, 90–110.

[13] E. D. van Oort. 1929. Resultaten van het Ringonderzek betreffende den Vogeltrek, Ingesteld door 'S Rijks Museum van Natuurlijke Historie te Leiden. XVI. *Zoologische Mededeelingen*, 12, 3–4, 217–247.

[14] 1930. *Ibid.*, XVII. *Ibid.*, 13, 155–177.

[15] 1931. *Ibid.*, XVIII. *Ibid.*, 14, 1–26.

[16] 1932. *Ibid.*, XIX. *Ibid.*, 15, 17–75.

[17] 1933. *Ibid.*, XX (Eerste Stuk). *Ibid.*, 16, 1–28.

[18] A. J. Sleijser. 1933. *Ibid.*, XX (Tweede Stuk). *Ibid.*, 16, 206–262.

Considerable data on longevity are given: a Heron (*Ardea cinerea*) of almost seven years (14 : 158); Cormorants (*Phalacrocorax carbo subcormoranus*) of five, six (17 : 1), and nearly seven years (13 : 217); a Lapwing (*Vanellus vanellus*) of nearly seven years (16 : 31); a Kestrel (*Falco tinnunculus*) of six and a half years (13 : 226); Hen Harrier (*Circus cyaneus*) and Montagu's Harrier (*Circus pyargus*) of six years (16 : 30); a Starling nearly six years (18 : 248) and a Magpie (*Pica pica pica*) of seven years (16 : 15). Higher ages were attained by the following: Sandwich Terns (*Sterna sandricensis*) of six, seven, and eight years (13 : 238); Herring Gulls (*Larus argentatus argentatus*) of five to twelve years (17 : 19) and Oystercatchers (*Hæmatopus ostralegus*) of ten and thirteen years.

Dr. H. N. Kluijver[19] has continued his researches on the Starling (See *Bird-Banding*, 1933, 4, 209–210) and now gives us a paper on this bird's relation to the fruit industry in Holland. Although it is beneficial in its destruction of insects, its depredations in orchards constitute a serious problem. Banding has shown that many of the young Starlings that attack fruit in June and July are raised in Germany.

German Banding Stations.—In the 27th Report of the Vogelwarte Rossitten[20], Dr. E. Schüz tells of the meeting of the Deutsche Ornithologische Gesellschaft in October and of the celebration of Dr. Thienemann's seventieth birthday. He describes the many lines of research carried on, particularly in regard to the White Stork, and summarizes the banding activities. Despite shortage of funds, space, and assistants, a great deal of important work is being accomplished.

The Helgoland Bird Observatory.—W. B. Alexander, 1934, *British Birds*, 27, 284–289. This is an interesting account of present-day banding activities on the historic ground where Gätke did his pioneer work in the study of migration. Birds are caught on the gallery of the lighthouse, occasionally as many as one thousand in a night, and are also captured in the *Fanggarten* by means of large traps into which the birds are driven. Mention is made of the various lines of research carried on, especially in problems of bird physiology, and the more important publications of Dr. Drost and Dr. Weigold are cited.

French Banding Papers.[21-28]—Le Service des Vertébrés (Institut des Recherches Agronomiques) in Versailles, under the direction of M. A. Chappellier has confined its banding activities to two species—the Rook (*Corvus frugilegus*) and the Heron (*Ardea cinerea*)—both of economic importance.

The most complete report of methods and results (23) contains a vivid narrative of banding young in a rookery and an account of efforts to inform the public to send in the bands. Each person reporting a capture receives a

[19] 1934. Het spreeuwenvraagstuk voor de fruitteelt. *Med. Plantenziektenkundigen Dienst te Wageningen*, No. 75. 1–15.

[20] 1934. XXVII. Bericht der Vogelwarte Rossitten der Kaiser Wilhelm-Gesellschaft zur Förderung der Wissenschaften. *Vogelzug*, 5, 74–86.

[21] Chappellier, A. 1926. Notes sur le Freux (*Corvus frugilegus* Linné). *Verh. Inter. Ornith- Kong.* pp. 457–464.

Diploma of Recovery and a record of the known history of the bird, including a map of France on which the points of banding and recovery are connected by an arrow.

By 1928, 2167 Rooks had been ringed and 2.16 per cent retaken, not counting young killed immediately after ringing near the rookery (23, p. 109). The author considers this a low percentage for a bird that is shot and poisoned in large numbers, and thinks that many rings are not reported. Ringing has distinguished two Rook populations in France: native birds that breed north of the Loire and remain sedentary throughout the year, and migrating birds that come from countries to the east and winter in France south of the Loire. One of the latter was found two winters after banding in southern Germany and another in Jugoslavia; so that although there seemed to be as many Rooks as usual in France, it is clear that these birds wintered in very different localities in different years—845 and 950 kilometers to the east (23, p. 120).

The birds banded in the nest were found to scatter out in all directions, but only one was found more than sixty-five kilometers from its birthplace. Several were taken in the home rookery during later breeding seasons, but one female was found nesting twenty-two kilometers from her birthplace.

The Carrion Crow (*Corvus corone*) is said never to breed in its second* year, but two of the year-old Rooks did so—both females. (How about our own Crows?) The loss of feathers around the bill in the Rook was found to be complete at about fifteen months (28).

From 1926 to 1928, 160 young Herons were banded in a famous heronry in the Marne; at the end of May, 1929, 21, or, 7.60 per cent, had been recovered, all but one of the birds being under one year of age. A striking map (23, p. 123) shows recoveries of all four young of one brood; one had been killed in its birthplace, one had started southeast, another was taken in western France, and the last in Spain. There are two main directions of dispersal of these birds—Belgium and Holland on the one side and the Atlantic Coast of France on the other.

In one of his pamphlets (26) M. Chappellier reviews at length Professor Thienemann's book on *Rossitten* and in another (25) he lists the banding stations throughout Europe, giving the addresses of the directors of each station and showing their location on a map.

[22] —— 1928. Quatre Freux (*Corvus frugilegus* Linné), bagués jeunes au Nid, sont repris près de, ou sur la Corbeautière ou ils étaient nés. *Bull. Soc. Zoologique de France*, 53, pp. 328–330.

[23] —— 1929. Le Service de Baguage du Ministère de l'Agriculture. *Ann. des Epiphytes*, 15 pp. 97–124.

[24] —— 1930. Un Dépot de Couleur Rouge sur des Bagues de Migration portées par des Hérons (*Ardea cinerea* Linné). *Revue d' Histoire Naturelle*, 11, pp. 1–4.

[25] —— 1930. Stations de Baguage. *Revue d' Histoire Naturelle*, 11, No. 6, pp. 1–10.

[26] —— 1930. Station Ornithologique et Organisation du Baguage en France. *Revue d' Histoire Naturelle*, 11, No. 7, pp. 1–25.

[27] —— 1931. Les Baguages de Freux (*Corvus frugilegus* Linné) du Service des Vertébrés, du centre national de Recherches Agronomiques de Versailles, et leurs premiers résultats. *Proc. VII Int. Ornith. Congress at Amsterdam*, 1930, pp. 320–323.

[28] —— 1932. A quel age le Freux (*Corvus frugilegus* L.) a-t-il terminé le Dénudation de la Base de son Bec? *L'Oiseau et la Revue Francaise d'Ornithologie*, No. 3, pp. 537–542.

*"Second" must be meant, *i.e.*, year-old birds.

WEIGHT

Variability in Weight in the Golden-crowned Sparrow.—J. M. Linsdale and E. L. Sumner, Sr., 1934. Univ. California Pub. Zool. 40, 5, 309–320. An important paper for those who are making studies of bird weights. The captive *Zonotrichia coronata* tended to weigh most in late afternoon, but often did so about midday. The variation in daily weight averaged about four per cent. Hot days caused a loss in weight. Wild birds of this species gained in weight during the spring of 1932 in the vicinity of Berkeley. The authors suggest "that weight measurement offers a means of gauging response of birds to heat and of determining possible relation of this factor to limitation of range or to initiation of migration in spring."

Studies on the Physiology of Reproduction in Birds. XXXIII.—*Body Size Changes in Doves and Pigeons Incident to Stages of the Reproductive Cycle.* O. Riddle and P. F. Braucher. 1934. *Am. Jour. Physiology*, 107, 343–347. "The body weight of adult doves and pigeons undergoes a cyclic increase of about 8 per cent in weight during the 15 or 18 days spent in the incubation of their eggs. Maximum weight is attained at the end of incubation. Nearly one-third of this increase occurs in the crop-glands . . . ." Yet about half the birds ate less during incubation than before. Doves with an average weight of 160 grams ate about 7.7 per cent of their body weight at this period in contrast to 8.6 per cent before; pigeons with an average weight of 360 grams ate 5.6 per cent of their weight while incubating, and 6.5 per cent before. The authors suggest that this "increase of weight on a diminished ration" may be due to the relative inactivity of the incubating bird.

LONGEVITY

A Starling nearly sixteen years old is reported by J. Jirsík[29]; ringed June 28, 1915, in Tupadly, Czechoslavakia, it was taken March 28, 1931, at Rimini, Italy. The late date gives support to the view that old birds make a leisurely spring migration. The author calls attention to the record of a Garden Warbler (*Sylvia borin*) that lived twenty-four years in captivity.[30]

Bird Banding Notes (2, No. 10, May 1934, U. S. Biol. Survey) mentions several notable records: a nine-year-old Bronzed Grackle (*Quiscalus quiscula æneus*) in Indiana; a nine-year-old Purple Finch (*Carpodacus p. purpureus*) in Maine, and a twelve and one-half-year-old Blue Jay (*Cyanocitta c. cristata*) in Michigan. Other records of longevity will be found under Banding in Switzerland and in Holland.

EFFECTS OF LIGHT

An interesting experiment was carried out by L. J. Cole[31] on subjecting several doves to artificially lengthened light-periods from December 11th to February 26th. One of these—a Mourning Dove—had bred in captivity for five years, the average date of her first egg having been April 3d; under the new conditions she started laying February 4th, but died March 16th.

[29] Der Zug des fau dem Gebiet der cechoslovakischen Republik nistenden Stares *Sturnus v. vulgaris L.* Deutsche Übersetzung der gleichnamigen Arbeit, die im Mai 1933 der Massarykova Akademie Práce eingereicht wurde. 1–17.

[30] Haarhaus. 1920. Mitteilungen aus dem Zoologischen Garten zu Halle, No. 1.

[31] 1933. The Relation of Light Periodicity to the Reproductive Cycle, Migration and Distribution of the Mourning Dove (*Zenaidura macroura carolinensis*). *Auk*, 50, 284–296.

The author suggests that "there may be a specific genetic difference in the day lengths to which the reproductive organization of different species respond," and that this "may serve to explain some of the outstanding features" of bird migration and distribution.

It has long been believed that birds in regions of heavy rainfall have dark plumage, but Colonel R. Meinertzhagen[32] shows that rainfall has nothing to do with pigmentation, but that it is due to the lack of ultra-violet rays in cloudy and foggy regions. It is of interest to learn that much the same relationship has been found with insects.[33]

TERRITORY

A great deal of excitement has been stirred up by "Territory Reviewed" by the Lacks (see April *Bird-Banding*). Several letters to *British Birds* have called attention to very early appearances of the territory theory, from Oliver Goldsmith in 1774 to Altum in 1868. C. B. Moffat (*British Birds*, 27, 235–236) refers to his article on "The Spring Rivalry of Birds" in "The Irish Naturalist," 1903, pp. 152–166, in which he contended "that the battles of the male birds, each claiming a territory, resulted in such a parcelling out of the land as must limit the number of breeding pairs to a fairly constant figure, and prevent indefinite increase in the case of any species—at the same time condemning the less powerful individuals to unproductiveness rather than to death." In the 1903 paper Moffat emphasized the fact that fighting is for territory and not for mates, that song is a matter of advertisement, while bright plumage is "a sort of 'warning colouration' to rival males."

Julian Huxley[34] describes the territorial behavior of Coots (*Fulica a. atra*) and Mute Swans (*Cygnus olor*) on a pool during the past winter. He writes: "In their paper the Lacks state that 'there is no real evidence' that 'the pugnacity of the male sets a definite limit to the number of pairs in a given area.' In the case of these Swans it would certainly appear that it was doing so. The pugnacity of the male (and to a lesser extent that of the female) is clearly seeing to it that one pair of Swans shall grow where two pairs grew before."

T. T. McCabe[35] concludes an excellent review of the Lacks' paper by saying: "It is an open question today whether research which consists of mere collation, of picking out brief fragments from scattered records, can build a picture of behavior which is of much value. The order of the day is completeness in detail and sequence in time, the concept of the pattern, of which the parts alone defy interpretation."

"Is the poor bird demented." Another case of "Shadow Boxing." —Wm. Ritter and S. B. Benson. 1934. *Auk*, 51, 169–179. A male Brown

[32] 1934. The relation between plumage and environment, with especial reference to the Outer Hebrides. *Ibis*, 13th ser. 4, 52–61.

[33] In Schröder's Handbuch der Entomologie, Vol. II, 1926, see O. Prochnow's chapter on Die Färbung der Insekten, pp. 430–572.

[34] A natural experiment on the territorial instinct. 1934. *Brit. Birds*, 27, 270–277.

[35] 1934. *News from the Bird-Banders*, 9, 11.

Towhee (*Pipilo fuscus petulans*) fought its image in a window every day from May 1st to July 4th, and again from September 23d "occasionally for some weeks." Statistics are given showing the astonishing amount of energy expended by this bird in defense of his territory. The authors state, "It is now certain that several species of resident birds in California keep, and defend to some extent, their territories throughout the year and for several years."

Song Sparrows and Territory.—M. M. Nice. 1934. *Condor*, 36, 49–57. An account of territory behavior in *Melospiza melodia beata*, describing the technique of territory-establishment and the relations of male and female to territory throughout the years. Maps give the history of four families, showing the nesting places of all known relatives.

Sex Rhythm in the Ruffed Grouse (*Bonasa umbellus* Linn.) **and Other Birds.** A. A. Allen. 1934. *Auk*, 51, 180–199.—A new theory of the purpose of territory is proposed here, as will be seen from the following quotations:

"Birds are not sex conscious, that is, they do not discriminate between the sexes as such" (p. 198).

"Male birds have a similar" (to females) "short mating period during which they are able to fertilize eggs" (p. 199).

"Bird behavior, . . . selection of territory, song, fighting, and display of plumage are explainable on the basis of the necessity for synchronizing the mating cycles of male and female" (p. 199).

The evidence brought forward to show that birds are not sex conscious consists first in a description of the behavior of Ruffed Grouse in captivity where males at times attempt to mate with males; secondly, a case of a homosexual union between two female Canada Geese in captivity; and thirdly, instances of males of various species attempting copulation with dead birds of their own species. There are, of course, many records of homosexual unions between captive birds of many species, both males and females, *but does this ever take place in the wild?*

I cannot imagine a domineering female Song Sparrow proclaiming territory for herself with her cracked and squeaky songs, nor a weak, humble male becoming the mate of a belligerent male, for the voices and behavior patterns are strikingly different in the two sexes, although the plumage is identical. Song Sparrows not only make no mistakes in the matter of getting the right sex for mates; they also know perfectly well which is male and which female among their Song Sparrow neighbors and behave accordingly.

As to the male's rhythm, Allen does not tell us on what this depends. In doves and other birds where the male incubates, perhaps he is not able to fertilize eggs during incubation. Riddle[36] has found that a hormone—prolactin—released by the anterior pituitary gland during incubation induces "rapid involution in the mature testes of ring doves." But also, with males that do not incubate, copulation usually ceases when incubation begins. Howard considers this due to the female's behavior, for he believes

[36] O. Riddle and R. W. Bates. 1933. Concerning Anterior Pituitary Hormones. *Endocrinology*, 17, 689–698.

that, "Throughout the cycle the male is physiologically prepared to conjugate."[37]. The canary does not seem to have been much changed by domestication, for it does not nest except in the normal breeding season; yet one male of this supposedly monogamous species can be made to serve 80 females in a season [38]—a fact which corroborates Howard's theory rather than Allen's. C.R. Carpenter (Jour. Comp. Psych. 16, 1933, p. 75) "suggests that the cyclic character of the reproductive activities of the male pigeon is determined, to a large degree, by the changing behavior of his female mate to which he responds, and to the resultants of the male's and female's social behavior, *i.e.* nest, eggs, and young.

With Song Sparrows the start of nesting depends primarily on the weather and both birds "synchronize" perfectly during mild days in April. The next "mating period" may start the day the young leave the nest, or perhaps not till ten days later, or it will come whenever a nest is broken up. Ruffed Grouse may have short mating periods, but two-to-three-brooded Passerines appear to be capable of coming into a mating period whenever the occasion arises.

Allen's account of the behavior of the Ruffed Grouse is full of interest and should be read in full. He has also done a service in pointing out that domination of the male over the female is in many cases one step in the reproductive cycle. But conclusions based on observations on normally solitary birds kept together in flocks in cages should be drawn with caution. Moreover, in this species association of the sexes in nature is reduced to a minimum, hence the situation differs radically from that in which both birds raise their broods together. I cannot believe that "synchronizing the mating cycles" is the explanation of territory.

LIFE-HISTORY

Permanent Mates. A very interesting case of a pair of Carrion Crows (*Corvus corone*) that have remained together for at least ten years and perhaps sixteen is reported by Robert Poncy[39-40], who has observed the birds since 1918 in the *Jardin des Anglais* at Geneva, where they stay throughout the year. In 1922 the female was injured in the left foot, and in 1924 the male in the right foot, both being thus permanently marked. Nest-building lasts over two weeks, the male constructing the outside, the female adding the lining. The female incubates, being fed to some extent by her mate. Fledging takes thirty-three to thirty-five days, after which the young stay another month with the parents. M. Poncy writes me that the pair nested again in 1933, but for some reason raised no young.

Bird Children of the Waika Reefs.[41] Great Black-backed, Herring, and Black-headed Gulls, Kittiwakes, Terns, Oyster-catchers, and Turnstones, the handsome Sheld-ducks, Scoters and motherly Eiders—all these with their eggs and babies are shown to us in the fine pictures and graphic, vivid text of this fascinating book. This is the record of a summer spent

[37] 1929. *Introduction to the Study of Bird Behaviour*, p. 74.

[38] H. Duncker. 1928. Genetik der Kanarienvögel. *Bibliographia Genetica*, 4, 37–140.

[39] 1931. Les Corneilles Noires à la Station ornithologique du Port de Genève. *Alauda* Ser. II, No. 4, 1–4.

[40] 1932. La Nidification des Corneilles Noires à la Station ornithologique du Port de Genève en 1932. *Alauda*, Ser. II, No. 4, 398–406.

[41] Franz Xaver, Graf Zedwitz. Vogelkinder der Waikariffe. 1933. Berlin. Scherl, RM 4.50

by Graf Zedwitz and his wife studying in a bird preserve of the University of Dorpat on the rocky reefs near the Island of Osel in the Baltic. The author is a keen observer and sympathetic interpreter of the rich life in this bird paradise, and his photographs are superb.

COÖPERATIVE ORNITHOLOGY

In connection with the reviewer's article in the April number of *Bird-Banding*, urging a coöperative attack on problems in bird-study, the plans of the British Trust for Ornithology (Report on Progress, *British Birds*, 1934, 27, 335–336) are of extraordinary interest. The whole basis of their work appears to be coöperation. At least six enterprises are under way—each with a leader and well-defined plans of action. These include investigating the status of the Woodcock, its distribution and fluctuations in numbers; the breeding biology of the Swallow; "the connexion between vole plagues and the breeding of Short-eared Owls"; a count of heronries; the Fulmar Petrel Investigation, and "a bird population inquiry" undertaken under David Lack "with a view to ascertaining the connexion, if any, between territorial habits, food supply and bird population."

Why cannot we adopt similar tactics?

A Field Guide to the Birds by Roger Tory Peterson. Published by Houghton Mifflin Company, Boston, 1934 (Reviewed by John B. May.)—At last the real "field book" on birds has been published. For many years I have been wanting a book which would show clearly the important field characteristics of our birds, so that he who runs might read, and this little volume fills that long-felt want, and fills it well. The only book which approached this desideratum was Ralph Hoffmann's "Guide to the Birds of New England and Eastern New York," published in 1904, which is still an extremely valuable book because of its terse paragraphs on field characteristics, but which was very inadequately illustrated, and which covered only the commoner birds of a limited area.

The present volume, which the publishers call "a bird book on a new plan," and which the author says was planned "to complement the standard ornithological works, a guide to the field-marks of Eastern birds, wherein live birds may be run down by impressions, patterns, and distinctive marks, rather than by the anatomical differences and measurements that the collector would find useful," is designed primarily for actual field use, and is of a size to slip conveniently into one's pocket, the pages being only $4\frac{1}{2}$ by $7\frac{1}{4}$ inches. The illustrations, however, like the plates in Forbush's "Birds of Massachusetts," are without margins, so that the individual figures are considerably larger than would be possible if the plates were printed with the usual white borders. The book consists of about two hundred pages of letter-press, terse and pithy paragraphs which emphasize distinguishing characteristics of each species, and a unique series of full-page plates, four in color and thirty-two in black and white. No attempt has been made to make "pretty pictures" but instead the figures on a single plate are all drawn in a slightly conventionalized manner, so that the distinguishing field marks of each species represented on that plate may be more easily recognized and comparisons made more readily. For example, the two plates of shore-birds show some thirty-three figures of birds in flight as they would appear if flying past the observer, exhibiting their diagnostic wing and tail patterns; the figures on each plate agree in scale of size, and their color-values are carefully rendered so that the

absence of color is not important. In this way attention is centered upon the important distinguishing characteristics instead of being confused by similarities and unimportant details. An idea of the lavishness of the illustrative material may be obtained by referring to the section on the ducks and geese; this includes six plates with sixty-three figures of birds as seen when swimming, and two plates with forty-six figures of ducks in flight, or one hundred and nine figures to illustrate forty species. Similarly the two colored plates of warblers show sixty-five figures illustrating forty-two species.

All in all, this book is a real contribution to the equipment of the bird-student, be he beginner or veteran. Mr. Peterson has been known for some time as one of the keenest and most reliable field men in the north-eastern district, and his unusual ability as a bird-painter is rapidly becoming recognized. Louisa May Alcott is said to have expressed her ambition to have her books "the most worn out" on her friends' tables, and this fate I believe is in store for Mr. Peterson's little volume, except that it will seldom leave its owner's pockets to decorate a study table.

CORRESPONDENCE

ECTOPARASITES

To the Editor of *Bird-Banding:* In the April issue of *Bird-Banding* appeared an article by Mrs. M. M. Nice, "The Opportunity of Bird-Banding," which mentioned a number of interesting and important problems which could be studied very effectively by banders. There was no mention made, however, of one very important phase of banding work, that relating to the external parasites found on birds. It seems to us that one of the most interesting opportunities which banders have is the chance to study the behavior of the birds as influenced by their external parasites. We know that parasites greatly affect domestic poultry, especially egg-laying, meat-production, and general well-being of the birds. Wild birds must react more or less the same to parasites. During our work in the past eight or ten years we have learned that practically every individual bird of practically every species has one or more (often as many as five or six or more) species of external parasites. When we remember that a parasite must exist at the expense of its host, we realize a bird cannot possibly react the same to its environment when infested with a number of ectoparasites. I believe they must affect the size, weight, health, color, habits, etc., of the bird as well as its migration dates and route. Banders making intensive studies of life-histories of certain species should certainly take this into consideration. From our continually increasing correspondence with banders we are obtaining an enormous number of interesting and valuable records of parasites and their relation to the bird and we appreciate their help in our work. The statements made in the first paragraph of my article in the April, 1930, issue of *Bird-Banding* are still borne out by our work during the four years elapsed since it was printed. In the article in the April, 1933, issue of *Bird-Banding*[1] there were a large number of records of parasites which had been collected and sent to us by banders. Quite a few additional records have accumulated since this was printed, and it is my hope that I shall be able to bring the list up to date in the not too far distant future. I hope banders will continue to observe and collect parasites from birds they handle and will correlate their presence and abundance with unusual and peculiar actions or appearances of the birds. We are very much interested in this study and shall be glad to do all we can to assist in this work.—HAROLD S. PETERS, Bureau of Entomology, Washington, D. C.

[1] Full references to these issues of *Bird-Banding* are Vol. I, No. 2, pp. 51–60, April, 1930 and Vol. IV, No. 2, pp. 68–75, April 1933.

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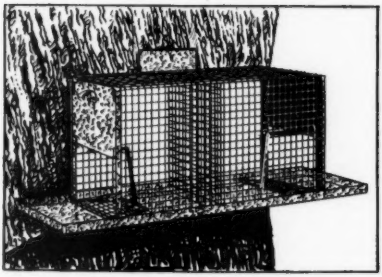

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